UNIVERSITY OF DELHI
निष्ठा धृति सत्यम्

RATAN TATA
LIBRARY

THE RATAN TATA LIBRARY

Cl. No. XN:76.55 G3

Ac. No. 27840

Date of release for loan

This book should be returned on or before the date last stamped below. An overdue charge of twelve nP. will be levied for each day/hour the book is kept beyond that date.

THE PRICE POLICIES OF GERMAN PUBLIC UTILITY UNDERTAKINGS

OXFORD
UNIVERSITY PRESS
AMEN HOUSE, E.C. 4
London Edinburgh Glasgow
Leipzig New York Toronto
Melbourne Capetown Bombay
Calcutta Madras Shanghai
HUMPHREY MILFORD
PUBLISHER TO THE
UNIVERSITY

THE PRICE POLICIES OF GERMAN PUBLIC UTILITY UNDERTAKINGS

By

H. E. BATSON, B.Sc. (ECON.)

Author of *A Select Bibliography of Modern Economic Theory, etc.*

1933
OXFORD UNIVERSITY PRESS
LONDON : HUMPHREY MILFORD

PRINTED IN GREAT BRITAIN

To my
MOTHER
and
FATHER

FOREWORD

In 1929 Sir Richard Garton founded a studentship of the annual value of £400 to enable a student of exceptional capacity to devote himself for a year or more to the study of social or economic problems of fundamental importance. The procedure followed by the Trustees has been to invite the universities of the Empire to make recommendations. Candidates are then required to submit a thesis and to propose the subject of research to which, should a candidate be successful, he would be prepared to devote himself during the tenure of the studentship. The theses are then examined by a specially appointed Committee, who report to the Trustees.

On the advice of the Board of Examiners the first Garton Studentship in the Social Sciences was awarded in 1929 to Mr. Harold E. Batson of the London School of Economics and Political Science, and the first-fruits of the award are the pages which follow. All readers will agree that in selecting Public Utilities for detailed study Mr. Batson has chosen a subject which is of fundamental importance and great contemporary interest. The satisfaction of the basic needs of modern communities presents novel problems of much technical and financial complexity with far-reaching economic and political reactions. Mr. Batson has been enabled to make a comparative study of the subject by visits to Germany and Italy, and while the Garton Trustees take no responsibility for the views expressed in this book, they commend Mr. Batson's work as a serious contribution to the analysis of the problem he set himself.

STANLEY BALDWIN.

PREFACE

THIS book contains historical matter relating to the growth and control of German gas, water, electricity, and tramway undertakings, a description of the methods of management at present employed in these local utilities, and a detailed analysis of their tariffs of charges, all with special although not exclusive reference to the largest German towns in February 1930.[1] This field was chosen, partly because Germany has more large towns than any other European country, partly because German public utilities possess some very distinctive and important special characteristics, and partly because it is a field which, although so large and diversified, is still practically virgin soil. Excellent monographs on its more controversial aspects and excellent articles in the technical journals have dealt with it piecemeal; but as yet no attempt has been made to present a bird's-eye view of the whole, such, for instance, as Professor Glaeser has attempted to present for America.

I have made no attempt to carry my figures beyond February 1930, for this is almost the last month that an annalist could regard as at least relatively normal for modern Germany. It is becoming quite clear that the early months of 1930 mark the end of an epoch and may in the eyes of future historians be as significant as 1919 and more significant than 1926. When things are happily 'normal' once again and managers of public utilities are able to act more like business-men and less like tax-collectors, then perhaps the time may be ripe for a revision of the present study. Interim experiences may well provide valuable material for the study of emergency finance, but not I think for that of public utilities.

Although I have tried to keep this book as objective as possible, it has seemed desirable to give some brief indication of the ideas which have guided me in the selection and arrangement of my material. This is the *raison d'être* of the first three and alternate subsequent chapters. In these chapters I may seem to have touched too dogmatically, perhaps too superficially, upon certain controverted questions of pure theory. I preferred to run this risk in order to be able to relegate the necessary working hypotheses of the study to as subordinate a position as possible, leaving the facts to speak for themselves. (Their voice, as is the way of such voices, is by no means unanimous.) I hope soon to publish discussions of some of these controverted questions.[1]

---

[1] With few exceptions, the first-hand investigations on which this book is based were restricted to towns with more than 200,000 inhabitants. In 1930 there were twenty-eight of these in Germany, viz.: Berlin, Hamburg, Cologne, Munich, Leipzig, Dresden, Breslau, Frankfort, Essen, Dortmund, Düsseldorf, Hanover, Nuremberg, Stuttgart, Chemnitz, Gelsenkirchen, Bremen, Magdeburg, Konigsberg, Duisburg, Stettin, Mannheim, Altona, Bochum, Kiel, Halle, Barmen and Elberfeld. Barmen and Elberfeld have since been incorporated in the single city of Wuppertal.

It is a great pleasure to record my deep obligation to what is, I am afraid, the disproportionately large number of gentlemen without whose help this book could not have been written.

My principal debt is to the Trustees and Secretary of the Garton Foundation, apart from whose assistance and kindly interest the work would not have been started upon. I am also greatly indebted to those who provided me with introductions and in other ways made my investigations easy for me. Among these, I should like to mention Stadtbaurat Richard Brix, of Vienna; Signor Buti, of the Italian Foreign Office; Sir Andrew Duncan, of the Central Electricity Board, London; Mr. S. Edwards, of the British Consulate in Berlin; Professor Emil Lederer, then of Heidelberg University; Mr. Marshall, of the Central Electricity Board; Ministerialrat Meckelburg, of the Prussian Ministry for Industry and Commerce; Sir Archibald Page, of the Central Electricity Board; and Professor Alberto de' Stefani, of Rome University.

It is a further pleasant duty to repeat my thanks to the local government officers, company managers, and secretaries of official bodies, whose courteous help has provided the material on which this book is based; and finally to my brother for preparing the manuscript, and to those of my colleagues, especially Professors Arnold Plant and Lionel Robbins and Dr. J. R. Hicks, who have helped me by criticizing it.

---

[1] The original thesis that I had planned on 'Public Utilities: an Economic, Administrative, and Legal Survey' has outgrown the decent limits of one volume. I hope shortly to bring out in book form that portion of it which I have used in my lectures on 'Public Utilities in their Economic Aspects' at the London School of Economics, and to publish a couple of chapters on Discrimination and the Mechanism of the Market respectively which practically amount to independent essays. A paper on 'The Economic Concept of a Public Utility', which I read at the Economic Club in February 1932, is shortly to be published in *Economica*.

Of course, none of these gentlemen is in the least responsible for any errors, whether of statistics or argument, that may have found their way into the book.

H. E. BATSON.

THE LONDON SCHOOL OF ECONOMICS,
May 1933.

CONTENTS

PAGE
FOREWORD by the Rt. Hon. STANLEY BALDWIN vii
PREFACE ix
LIST OF TABLES IN THE TEXT xvii
LIST OF DIAGRAMS IN THE TEXT xix

CHAPTER I

THE PROBLEMS OF PUBLIC-UTILITY CONTROL

The nature of public utilities. The scope of public utility control. I. The decision as to degree of competition. II. The decision as to management. III. The decision as to profits. IV. The decision as to differentiation of prices. . . . . *page* 1

CHAPTER II

GERMAN METHODS OF PUBLIC-UTILITY CONTROL

Solutions of Problem I. The theoretical case against competition in the public utility industries. The position under German law. Direct competition actually avoided in Germany, but not indirect competition. *Solutions of Problem II.* Pros and cons of public management, of private management, and of 'mixed management'. The various forms of management in German law. The history of the various forms of management in Germany dealt with in Chapter 3. *Solutions of Problem III.* Theoretical difficulties concerning 'fair' profits. The profits of public utilities under German law. German practice regarding the profits of public utilities. *Solutions of Problem IV.* The theoretical significance of the question of price-differentiation. Price-differentiation under German law. German practice dealt with in Chapters 4–11 . . . . *page* 5

CHAPTER III

THE HISTORY OF PUBLIC-UTILITY MANAGEMENT IN GERMANY

The history of public utility management in Germany divisible into three stages. THE PERIOD OF PRIVATE OPERATION. Gas. Tramways. Electricity. In general. THE PERIOD OF PUBLIC OPERATION. Water. Gas. Electricity. Tramways. In general. THE PERIOD OF EXPERIMENT WITH COMPROMISE FORMS OF MANAGEMENT. Divisible into five stages. I. *Experiment, 1908–14,* typified by the R.W.E. II. *Temporary Extension, 1914–18,* typified by the Strasburg Gesellschaft für Volksernährung m.b.H. III. *Socialism, 1918–21.* IV. *Currency Inflation, 1922–3.* V. *'Improved Public Management', 1924–30,* typified by the Werke der Stadt Halle A.G. GENERAL SUMMARY AND CONCLUSIONS . . . . *page* 18

CHAPTER IV

WATER-SUPPLY: CHARACTERISTICS

I. ECONOMIC CHARACTERISTICS. (a) *Nature of Costs.* Tacit assumptions of the theory that prices will approximate to costs. Nature and significance of overhead costs. 'Imputation' of overhead costs by equal division, by arbitrary division, by 'charging what the traffic will bear'. Advantages of the latter method from the point of view of the undertaking, of the customers charged less than the average, and of the customers charged more than the average. Cost-structure of the water-supply industry. (b) *Measurement of the Commodity.* (c) *Structure of the Market.* Differentiation of prices dependent on separability of markets. Natural separation of markets. Artificial separation dependent on cost of transfer of commodities and on possibility of conducting business so that different customers pay different prices in the first place. Natural separation of markets for water chiefly associated with time at which supply is taken. Load-curves. The Load Factor. The Capacity Factor and the definition of 'capacity'. Artificial separation of markets for water. (d) *Conditions of Storage.* (e) *Area of Supply.*

II. SOCIAL CHARACTERISTICS. (a) *Importance to the Community.* (b) *Consumption by the Community.*
Impossibility of devising a method of charging that will realize all economic and social ideals . . . . . . *page* 60

CHAPTER V

WATER-SUPPLY: CHARGES

I. CLASSIFICATION OF CUSTOMERS. Fire-hydrants, river water, public uses, supplies outside the city boundaries, minor classifications. The division between domestic and industrial consumers.

II. TARIFFS. Kinds of tariffs. Flat-rate tariffs. Discount tariffs—step tariffs, improved step tariffs, block tariffs. Flat-rate two-part tariffs. Discount two-part tariffs. The standing-charge element in two-part tariffs. Fixed-charge tariffs. Summary. The ideal tariff . . *page* 88

CHAPTER VI

GAS-SUPPLY: CHARACTERISTICS

I. ECONOMIC CHARACTERISTICS. (a) *Nature of Costs.* (b) *Measurement of the Commodity.* (c) *Structure of the Market.* Load-curves. Competition of electricity, &c. (d) *Conditions of Storage.* (e) *Area of Supply.* 'Ferngas'.

II. SOCIAL CHARACTERISTICS. (a) *Importance to the Community.* (b) *Consumption by the Community.*
The ideal method of charging. New elements not contained in problems of charging for water . . . . . . *page* 109

CHAPTER VII

GAS-SUPPLY: CHARGES

I. CLASSIFICATION OF CUSTOMERS. Theoretical considerations concerning the classification of customers. The situation in the German gas industry. Special rates for industrial consumers. Heating-gas. Prepayment charges.

II. TARIFFS. Extent of employment of different kinds of tariff. Advantages and disadvantages of the various kinds of tariff. The position of the small consumer. The nature of the small consumer. Alternative tariffs. The standing-charge element in two-part tariffs. 'Imputation' of overhead costs. Standards of grading. The ideal gas-tariff . . . *page* 120

CHAPTER VIII

ELECTRICITY-SUPPLY: CHARACTERISTICS

I. ECONOMIC CHARACTERISTICS. (a) *Nature of Costs.* (b) *Measurement of the Commodity.* (c) *Structure of the Market.* Elements of the lighting demand. Elements of the power demand. Qualitative indeterminateness of demand. Lighting load-curves. Power load-curves. Storage by customers. Stand-by demands. (d) *Conditions of Storage.* 'Discouragement' of peak demands. (e) *Area of Supply.* Recent developments.

II. SOCIAL CHARACTERISTICS. (a) *Importance to the Community.* The official connexion of electricity with hygiene. (b) *Consumption by the Community.* *page* 139

CHAPTER IX

ELECTRICITY-SUPPLY: CHARGES

Complexity of the problem of electricity tariffs. Load-curve considerations.

I. CLASSIFICATION OF CUSTOMERS. Lighting and power consumers. Theoretical considerations concerning power-rates. German practice regarding power-rates. General tariffs. General domestic tariffs. Special domestic tariffs. Advertisement-lighting tariffs. Other off-peak-lighting tariffs. Off-peak-power tariffs. General off-peak tariffs. General industrial tariffs. Special industrial tariffs. Staircase-lighting tariffs. Summary. Complete tariff-schemes.

II. TARIFFS. Employment of various kinds of tariff in the German electrical industry. Meter-rents and other standing charges. Pure standing-charge tariffs. Special prices. Provisions relating to time of consumption. Off-peak tariffs. On-and-off-peak tariffs. Load-factor tariffs. Coal clauses. Stand-by supplies. High-tension supplies. The ideal tariff-combination. The desirability of wider publicity . . . . . *page* 154

CHAPTER X

TRAMWAYS: CHARACTERISTICS

I. ECONOMIC CHARACTERISTICS. (a) *Measurement of the Commodity.* (b) *Nature of Costs.* (c) *Structure of the Market.* Load-curves. (d) *Conditions of storage.* (e) *Area of supply.*

II. SOCIAL CHARACTERISTICS. (a) *Importance to the Community.* (b) *Consumption by the Community* . . . . . *page* 183

CHAPTER XI

TRAMWAYS: CHARGES

I. CLASSIFICATION OF CUSTOMERS. 'Social' versus 'economic' considerations. Scholars' fares. Children's fares. Students' and apprentices' fares. Workmen's fares. Blind persons' fares.

II. TARIFFS. Variation with regard to number of passengers.
Variation with regard to distance. (A) *Variation in Proportion to Distance Travelled.* 1. The Fare-stage Tariff. 2. The Uniform-fare Tariff. 3. The

Transfer Tariff. Books of tickets and weekly tickets. (B) *Variation independently of Distance Travelled.* Season Tickets.
Variation of fare according to time at which journey is made.
The ideal system of charging . . . . . . *page* 190

CHAPTER XII
CONCLUSION

The need for a body of thought on the economic aspects of public utilities. The utility of such a body of thought to economists, politicians, and public administrators, and to the public utilities themselves. The broad principles and their present application to Germany . . . *page* 213

INDEX . . . . *page* 217

TABLES

PAGE

I. Profits of German Publicly-operated Utility Undertakings, 1929 16

II. History of Public-Utility Management in twenty-eight German Cities 18

III. Original Form of Management of Public Utilities . 23

IV. Average Period of Private Management of Public Utilities 23

V. Mixed Undertakings in Germany, 1920 . . . 41

VI. Public Undertakings in Company Form, 1930 . . 47

VII. Number of Mixed Undertakings in the twenty-eight largest German Cities, at the beginning of 1930 . . 48

VIII. History of the Mixed Undertaking in twenty-eight German Cities 51

IX. Public and Mixed Undertakings in Germany, 1920 . 52

X. Analysis of Table IX 52

XI. History of Ownership of all German Gasworks . . 53

XII. Management of Public-Utility Undertakings in twenty-eight German Cities on January 1st, 1930 . . 56

XIII. Public Utilities in Prussia 56

XIV. Employees of Public Utilities in Prussia . . . 57

XV. Management of Gas Industry in 1926 . . . 57

XVI. Management of Electricity Industry in 1928 . . 58

XVII. Management of Tramway Industry in 1928 . . 58

XVIII. Management of Utilities in Germany . . . 59

XIX. Average Expenditure on Utility Services . . 73

XX. Customer-groups for Water Tariffs . . . 89

XXI. Types of Water Tariff 94

XXII. Charges for Heating-Gas 126

XXIII. Prepayment Charges for Gas 128

XXIV. Types of Gas Tariff 130

XXV. Customer-groups for Gas Tariffs 131

XXVI. Light and Power Rates for Electricity . . . 159

XXVII. Advertisement Rates for Electricity . . . 163

XXVIII. Power Rates for Electricity 165

XXIX. Customer-groups for Electricity Tariffs . . . 167

XXX. Standing Charges in Electricity Tariffs . . . 171

XXXI. Meter Rents in Electricity Tariffs . . . 172

XXXII. Scholars' Fares 191

XXXIII. Children's Fares 192

PAGE
XXXIV. Typical Scales of Children's Fares . . . 193
XXXV. Students' and Apprentices' Fares . . . 193
XXXVI. Workmen's Fares 194
XXXVII. Blind Persons' Fares 195
XXXVIII. 'Social' Tramway Tariffs 201
XXXIX. Types of Tramway Tariffs 206
XL. Books of Tickets and Weekly Tickets . . . 207
XLI. Monthly Season Tickets 209
XLII. Use of Tramway Facilities in twenty-eight Towns . 210
XLIII. Fares for Night Journeys 211

DIAGRAMS

PAGE

I. Changes in the Management of Public Utilities in twenty-eight German Cities 24
II. History of the Management of Water Undertakings in twenty-eight German Cities 25
III. History of the Management of Gas Undertakings in twenty-eight German Cities 26
IV. History of the Management of Electricity Undertakings in twenty-eight German Cities 27
V. History of the Management of Tramway Undertakings in twenty-eight German Cities 28
VI. Fluctuation of Stettin Tramway Fares in Gold Mark Values . . . . . . *facing* 43
VII. History of the Management of Water Undertakings . 49
VIII. History of the Management of Gas Undertakings . 49
IX. History of the Management of Electricity Undertakings . 50
X. History of the Management of Tramway Undertakings . 50
XI. Development of the Management of Water Undertakings 54
XII. Development of the Management of Gas Undertakings . 54
XIII. Development of the Management of Electricity Undertakings 55
XIV. Development of the Management of Tramway Undertakings 55
XV. Typical Hourly Fluctuations in the Demand for Water . 77
XVI. Daily Load-Curve of Typical Water Undertaking . 78
XVII. Weekly Load-Curve of Typical Water Undertaking . 78
XVIII. Annual Load-Curve of Typical Water Undertaking . 78
XIX. Load Factor and Capacity Factor . . . 81
XX. Total Cost of Supplying Water to a given Consumer . 95
XXI. Total Cost of Supplying Water to a given Consumer (alternative arrangement) 96
XXII. Cost and Price Curves 96
XXIII. Water Tariff, Step Type 97
XXIV. Water Tariff, Improved Step Type . . . 99
XXV. Water Tariff, Flat-rate Type with Meter Rents . . 101
XXVI. Correspondence between Costs and Flat-rate Charges . 103
XXVII. Meter Rents in Water Tariffs 104
XXVIII. Daily Load-Curve of Typical Gas Undertaking . . 112
XXIX. Weekly Load-Curve of Typical Gas Undertaking . 112
XXX. Annual Load-Curve of Typical Gas Undertaking . 112

PAGE
XXXI. Effect of Alternative Tariffs 135
XXXII. Meter Rents in Gas Tariffs 137
XXXIII. Daily Lighting Load-Curve of Typical Electricity Undertaking (Spring or Autumn) 144
XXXIV. Weekly Lighting Load-Curve of Typical Electricity Undertaking 144
XXXV. Annual Lighting Load-Curve of Typical Electricity Undertaking 144
XXXVI. Daily Power Load-Curve of Typical Electricity Undertaking 146
XXXVII. Weekly Power Load-Curve of Typical Electricity Undertaking 146
XXXVIII. Annual Power Load-Curve of Typical Electricity Undertaking 146
XXXIX. Model Showing Variations in Load on a Central Electricity Station 148
XL. Idealized Load-Curves 149
XLI. Meter Rents in Domestic Electricity Tariffs . . 173
XLII. Meter Rents in General and Industrial Electricity Tariffs 174
XLIII. Standing Charges in Domestic Electricity Tariffs . 177
XLIV. Daily Load-Curve of Typical Tramway Undertaking (Inward Traffic) 187
XLV. Daily Load-Curve of Typical Tramway Undertaking (Outward Traffic) 187
XLVI. Weekly Load-Curve of Typical Tramway Undertaking (All Traffic) 187
XLVII. Annual Load-Curve of Typical Tramway Undertaking (All Traffic) 188
XLVIII. Typical Fare-stage Tariff Tram Ticket, Map Type . 202
XLIX. Typical Fare-stage Tariff Tram Ticket, List Type . 203
L. Typical Uniform Transfer Tariff Tram Ticket, Map Type 203
LI. Typical Uniform Transfer Tariff Tram Ticket, List Type 204
LII. Tariffs in Three Local Utilities . . . 215

CHAPTER I

THE PROBLEMS OF PUBLIC-UTILITY CONTROL

EVEN in extremely individualistic countries, water, gas, electricity, and tramway undertakings are seldom left to ordinary private enterprise.

This has not always been so; and even now different governments employ different methods of control. In America these undertakings are usually scheduled as 'public utilities' and thus brought within the scope of a complex and extensive legal code. In Germany the local government authorities often operate the undertakings themselves. In England some undertakings are publicly operated and others are left in private hands but controlled by Special and General Acts of Parliament. But although the method of control may vary, the fact of control is almost universal.

It is not necessary to enter here into a discussion of the economic reasons for this, or even to ask if there are any economic reasons for it at all. The present study accepts State control of these undertakings as a political fact, and analyses experiences which may shed some light on the economic problems that such control has to solve. For even political force is subject to laws, and a government can no more control the actions of a waterworks company without reference to economic laws than it could control the flow of water from its reservoirs without reference to the laws of hydraulics.

In the modern world, prices are the index and incentive of most business activity. It is therefore not surprising that the sort of regulation with which we are concerned deals primarily with the prices charged by undertakings for their services. Some economists see in this the cause and justification of the regulation; others its effect and condemnation. At this point it is not necessary for us to decide which of these views is right and which wrong; it is sufficient to recognize that the regulation of public utilities—to adopt the usual American term—is chiefly a matter of price control.

But price control necessitates other sorts of control as well, just as control of the water-level in a reservoir necessitates control of inflows and outflows. Regulators of public utilities have consequently been obliged to interfere with other matters besides prices. Some of these may arise at a later logical stage than the price regulation proper. With these we are not immediately concerned. But others necessarily present themselves before the question of price regulation can be logically dealt with at all. Of these, those mentioned under I–III below are the most important.

I. At the outset the decision has to be taken whether the public-utility undertaking that is to be controlled shall be made a competitive or a monopolistic undertaking. Early attempts at regulation were influenced by contemporary political and economic theory and competition was preferred on grounds of abstract principle, but nowadays public-utility regulation in most cases aims at the establishment of a monopoly.

II. Having decided what form the industry or section of an industry shall take, the controlling authority has next to decide by whom the undertakings composing the industry shall be operated. Broadly speaking, two courses are possible. The undertakings may be left in private hands, or they may be operated by the government.

III. If the decision is made to organize the industry monopolistically, it may be felt desirable to provide a legislative substitute for the competitive check on profits. This involves two difficulties. The first is that of deciding what amount of profit should be allowed to the undertaking. When this problem has been solved, the addition of the estimated costs for the period under consideration gives the total revenue which the undertaking must be allowed to collect by means of its charges (and, of course, from any other source of revenue which it may possess). But there are theoretical as well as practical difficulties even in the apparently straightforward process of calculating the total costs incurred during a given period; for it is here that the problem of the allocation of overhead costs is first met with, in the attempt to determine how depreciation or amortisation costs shall be divided among successive financial periods. It is not always realized that this, like all overhead cost problems, cannot be solved solely by considerations of supply.

IV. When this stage has been reached, and only then, is it possible to proceed with the problem that lies at the heart of public-utility regulation—that of controlling the prices charged for individual units of commodity. This is usually expressed in popular terminology by saying that the object of control is to prevent discrimination. The term discrimination has different meanings in different contexts; but in contexts that have to do with public utilities it has at least a minimum reference to differentiation of prices where uniformity is regarded as the standard—a standard usually drawn from a more or less logical conception of the 'results of free competition'.

But not all public-utility regulation is based on the desire to bring about in the regulated industries such results as are supposed to be obtained elsewhere without special regulation. Some regulation aims at securing results that are not usually obtained without socialistic interference in any part of the present economic system. The first sort of regulation aims at preventing discrimination. The second sort aims at establishing discrimination in order to attain certain social ends. These ends are often attempted solutions of questions concerning the inequality of incomes, such as are not in the ordinary course allowed to invade the domain of price-determination.

Two characteristics make the public utilities particularly suitable fields for social experiment. The first of these is that they provide services that are widely considered to be indispensable, and that a large part of the community is therefore obliged to buy from them whether the prices charged are high or low. In other words the demand for their products is, over a wide range of prices, relatively inelastic. It is, in fact, those circumstances which would make the public utilities such a remunerative field for the monopolist that make them such an attractive field to the social reformer. The second fact that makes it easy for the reformer to use the public-utility industries as a medium for the execution of his schemes is that some sort of regulation of these industries is in any case generally admitted to be necessary by individualists as well as by socialists; and that it is impossible for any but experts to say exactly where regulation ceases to be conservative and becomes reformatory. Thus it is a far simpler matter to circumvent political opposition in these cases than where all regulation would have to be admittedly reformatory in nature and purpose.

Regulation aiming at a modification of the effects of inequality of incomes, such as has been described, would normally take the form of provision for discrimination in favour of small consumers. Such is the case, for example, in Vienna, where 35 litres of water per head per day are supplied free of charge to all consumers. The result of this is that the smaller consumers, who are on the whole those who live in the smaller dwellings and are therefore those with the smaller incomes, pay a lower price per litre for their total consumption than the more well-to-do consumers pay.

Sometimes the social ends pursued by regulation of this type are not so obviously and immediately concerned with the distribution of commodities among individuals. Many tramways, for example, discriminate against short-distance passengers in order to encourage the decentralization of the population in their area.

Again, the social ends in view may be achieved not by direct influence on the private lives of individuals, but through the industrial organization of the whole country. Thus, if it were desired to assist the development of a particular industry, relatively low railway rates might be granted, either (i) for the products of that industry, or (ii) for all goods carried to and from the districts where that industry was established, or (iii) for materials carried for undertakings in that industry. Regulation of this kind is seldom openly advocated nowadays, but the principle which underlies it finds surprisingly wide application in various disguised forms, especially in the 'local' utilities. Again, the transfer of industries from one region to another could be hindered or facilitated by means of a suitable public-utility tariff policy.

All such differentiation as this involves principles which are very similar to those involved by the granting of subsidies. In the last resort, the matter is one to be decided not by the economists but by the politicians.

The following pages without entering into avoidable theoretical discussions attempt to describe some of the ways in which these problems have been dealt with in Germany.

FURTHER READING ON CHAPTER I

There are no standard English or German works on the general economic theory of public utilities. One of the most comprehensive American books on the subject is *Outlines of Public Utility Economics* by Martin G. Glaeser, Macmillan, New York, 1927, pp. xxvi+847. A useful series of papers on the 'Administration of Public Utilities' was read at the 1926 Summer Conference of the Institute of Public Administration and published in *Public Administration*, Humphrey Milford, London, 1926, vol. iv, No. 4. See also page x of the present work.

CHAPTER II

GERMAN METHODS OF PUBLIC-UTILITY CONTROL

Solutions of Problem I.

It has been pointed out that the first question that has to be decided by a regulating authority is whether the controlled industry is to be monopolistic or competitive. In Germany the four local utilities under consideration have been almost without exception established as monopolies. This has occurred without any specific legal sanction, simply because the local authorities have considered the case for monopoly to be self-evident.

The above refers only to direct competition, however, such as might exist between two gas undertakings supplying the same street. Indirect competition has always existed in the local-utility industries. Gas and electricity are to a large extent substitutes for one another, and there is consequently a certain amount of competition between the two industries in towns, such as Berlin and Essen, where the two undertakings are in separate hands. At the beginning of this century this inter-industrial competition was limited to the sphere of lighting. Nowadays in all large towns lighting is for the most part surrendered to electricity, but the battle still rages fiercely in the fields of domestic cooking and heating and industrial power. An interesting situation arises when the gas and electricity supplies are both in the hands of the same undertaker, whether private or municipal. In the twenty-eight cities of this investigation this situation occurs twenty times, and in every case the undertaker is the municipality. An undertaker in such a position is faced with the problem of deciding exactly what degree of indirect competition to permit between the two types of service. Sometimes by means of rigid departmentalization the two undertakings are treated as entirely independent concerns and allowed to compete with one another whenever commercial principles invite such competition. More usually a general price system is evolved for both undertakings considered as one unit with the object of excluding competition as far as is possible and delimiting the fields of operation of the two undertakings. Perhaps this is not always done consciously, but it is the more usual plan of the two.

Competition between different tramways might exist where two adjacent areas are served by parallel systems, as occasionally occurs in the Ruhr district, for instance. It would seem that some sort of an understanding usually exists between the 'competitors' in such cases, however, which practically converts their undertakings into a monopoly. This is often facilitated by the existence of a large degree of mixed management in tramway companies.[1] Competition between tramways and railways often exists, in theory at least; but the services provided by the two kinds of undertaking differ so widely from each other that the amount of real competition between them is not so great as might be at first assumed. Competition between tramways and omnibuses is very unusual in Germany. Apart from the 'Kraftpostwagen', which are operated by the Post Office and have a monopoly of the country traffic but do not run in urban areas, the chief omnibus routes are either operated by the tramway undertakings as subsidiary services, or else they are definitely confined to areas in which they do not compete with the tramways. Except in a few very large towns, passengers seldom have a choice between 'bus and tram for travelling from a given point to another. The amount of competition between the two types of service is still further reduced by the fact that the 'buses usually provide a higher standard of comfort than the trams and, their fares being higher, attract a different type of passenger.[2] The division between the two is in many respects comparable with that between first and third class railway accommodation. The underground railways in Berlin and Hamburg and the overhead railway in Barmen and Elberfeld similarly co-operate with and do not compete with the tramways.

Even in the water-supply industry a sort of indirect competition exists wherever people living in a district served by one undertaking have the option of moving to another district. This possibility has probably more effect than might at first appear, if we may judge from the way in which disgruntled customers have a habit of using the prices ruling in other districts as an argument for the reduction of their own.[3]

When we say, then, that the four local utilities in Germany have almost without exception been established as monopolies, it is with implied qualifications.

---

[1] See C. König, 'Die kommunale Neugliederung im Rheinland und Westfalen und ihre Bedeutung für den Verkehr', *Verkehrstechnik*, Berlin, 1930, pp. 25-31.

[2] An exception must be made in favour of the Berlin 'buses, which are not at all comfortable.

[3] I am indebted to Dr. F. C. Benham for an interesting suggestion on this point.

Solutions of Problem II.

Broadly speaking, two alternative courses are open to a government authority, whether central or local, that has decided to interfere with the conduct of an economic enterprise. The first possible policy is the establishment of a system of controlled private management. The second is the direct management of the enterprise by the authority itself. The former of these two policies has been generally adopted in America, while in Europe both methods have been tried side by side. Neither, however, has been found quite satisfactory in practice.

The chief objections that are usually made to public management are (i) that it is cumbersome and unenterprising; (ii) that its financial methods tend to be those of the administrative rather than of the business world; (iii) that it permits abuses in the form of undesirable political influence; (iv) that the area of jurisdiction of the managing authority is by no means necessarily the most suitable area for the conduct of the managed undertaking; and (v) that the establishment, or to a lesser extent the purchase, of a large undertaking by a public authority throws an undesirable burden upon the finances of the authority, particularly if much risk is involved.

The disadvantages of controlled private management are not less serious. Perhaps the chief of them are: (i) the practical impossibility of drafting a set of regulations for the conduct of the undertaking that will be continuously equitable; and (ii) the inflexibility and incompleteness of such regulations as it is possible to frame.

The choice between the two policies remains in the last resort a political matter, although economic considerations should greatly influence the decision. In general, public management would be preferable when the safeguarding of certain social aims was held to be the paramount necessity of the case,[1] whilst private management would be preferable where the complexity or magnitude or novelty of the undertaking was considered to demand resources beyond the capacity of the controlling body.

---

[1] 'Eine Stadt, die die Versorgung mit Wasser, Gas und Strom dem Privatunternehmer freigibt, kommt mir wie ein Haushalt vor, der seine Küche zu führen Dritten überlässt.' Herr Pichler, Superintendent of the Mannheim Gas-, Water-, and Electricity-works, in *Die Regiebetriebe der Gemeinden*, p. 80.

Shortly before the Great War, in Germany and elsewhere, the principle of 'mixed management', as it was called, began to be experimented with in the attempt to avoid some of the graver disadvantages of purely private or public management. The essential characteristic of the mixed undertaking is the co-operation of one or more public authorities with one or more private parties to form a company, to the capital of which each party contributes and in the management of which each party has a voice.[1] It has been claimed for this type of management that it overcomes nearly all the difficulties mentioned above and offers in addition certain positive advantages over both the older alternatives. There was a time indeed when, according to Dr. Passow,[2] some authorities were of the opinion that the mixed undertaking was not merely one form, but *the* future form for municipal trading enterprises. Few would now hold such a view as that.

The chief present-day opponents of the principle of mixed management belong to the hostile camps of private industry and socialistically-minded local government. The chief objections that are met with from the public authorities are (i) that the mixed management of local utilities permits the entry of profit-making motives into a business that should be operated solely with a view to the benefit of the public;[3] and (ii) that the mixed undertakings are in any case not necessarily more businesslike or less bureaucratic than properly conducted public undertakings.[4]

---

[1] 'Unter gemischt privaten und öffentlichen Unternehmungen werden im folgenden solche Unternehmungen verstanden, bei denen das verantwortliche, das eigene Unternehmungskapital teils von Privaten, teils von öffentlichen Körperschaften (insbesondere Städten und Kreisen) aufgebracht ist und bei denen auch die oberste Leitung des Betriebes auf Grund des gemeinschaftlichen Eigentums von Privaten und öffentlichen Körperschaften gemeinsame ausgeübt wird.' R. Passow, *Die gemischt privaten und öffentlichen Unternehmungen*, p. 1.

[2] R. Passow, op. cit., p. iii.

[3] 'Andere Gesellschaftsbeteiligte dürfen nicht mitwirken, damit die kommunalen Interessen rein zur Durchführung kommen.' *Die Regiebetriebe der Gemeinden*, p. 48. Dr. Brauer, Chief Burgomaster of Altona.

'Vielleicht sind gemischtwirtschaftliche Betriebe infolge ihrer grösseren Beweglichkeit in gewissem Masse leistungsfähiger, jedoch bergen sie die grosse Gefahr des Überwuchens privatwirtschaftlicher Interessen und des Hinausgleitens des Betriebes aus den Händen der städtischen Behörden.' Ibid., p. 49. Dr. Rhein, Bremen.

'Ich bin kein Freund des gemischtwirtschaftlichen Betriebes. Bei derartigen Betrieben ist die führende Privatgesellschaft immer bestrebt, besondere Vorteile, verschleiert oder offen, aus dem Werk herauszuholen.' Ibid., p. 85. Dr. Maul, Superintendent of the Glogau Gas- and Water-works.

[4] 'Die Überführung rein städtischer Betriebe in gemischtwirtschaftliche

The most important objection to mixed management that is advanced nowadays by protagonists of private industry is that the mixed undertaking is less businesslike than the private undertaking, and embodies in fact most of the undesirable features of purely public management.

Where experts—admittedly with conflicting interests—hold

Unternehmungen ist *nicht* zu empfehlen. Die gemischtwirtschaftliche Form bildet keine grössere Gewähr für die Wirtschaftlichkeit des Betriebes; die Vorzüge des kaufmännischen Betriebes lassen sich im Rahmen des rein städtischen Betriebes erreichen.' Ibid., p. 17. E. Schmid, sometime Burgomaster of Munich.

'Es liegt kein innerer Grund vor, warum etwa gemischtwirtschaftliche Betriebe besser arbeiten sollten als rein kommunale Betriebe, soweit letzteren eine privatwirtschaftliche Unternehmungsform gegeben wird. Neue gemischtwirtschaftliche Unternehmungen zu gründen, hat keinen rechten Sinn. Die bestehenden sind meist entstanden durch Ablösung von Rechten, die in früheren Jahren erteilt worden sind.' Ibid., p. 20. Dr. Ritter, First Burgomaster of Mannheim.

'Gemischtwirtschaftliche Betriebe brauchen nicht leistungsfähiger zu sein als reine Kommunalbetriebe.' Ibid., p. 25. Dr. Karding, sometime City Treasurer of Berlin.

'Alle die Gründe, die von der Gegenseite angeführt werden, wie leichtere Handhabung des Betriebes, leichtere Geldbeschaffungsmöglichkeit, kaufmännischer Geist usw., können bei einem rein städtischen Betrieb genau so gut Platz greifen wie bei einem gemischtwirtschaftlichen oder rein privatwirtschaftlichen Betrieb.' Ibid., pp. 30–1. Dr. Mohrmann, Burgomaster of Wesermünde.

'Die Gefahr der Bureaukratisierung liegt bei ihm genau so, wie beim Regiebetrieb, wenn er keine Konkurrenz hat, dafur besteht die Gefahr rein privatwirtschaftlicher Einstellung, durch welche die ganzen Vorteile der Besitze in öffentlicher Hand verlorengehen können.' Ibid., p. 38. Dr. Luppe, Chief Burgomaster of Nuremberg.

'Ich sehe keinen Grund, weshalb eine gemischtwirtschaftliche Unternehmung leistungsfähiger sein soll als die rein kommunale.' Ibid., p. 42. B. Asche, City Treasurer of Frankfort-on-Main.

'Die rein städtischen Betriebe arbeiten mindestens ebenso wirtschaftlich wie Privataktiengesellschaften'. Ibid., p. 87. Dr. Heine, Superintendent of the Potsdam Gasworks.

'Die Leistungsfähigkeit hängt in der Hauptsache von den Fähigkeiten und der Bewegungsfreiheit des Betriebsleiters ab. Ein tüchtiger Leiter mit der nötigen Selbständigkeit wird die Leistungsfähigkeit im Interesse der Allgemeinheit weiter bringen können, als es den gemischtwirtschaftlichen Betrieben möglich ist.' Ibid., p. 88. Dr. Bachmeyer, Superintendent of the Guben Public Works.

'Die Behauptung, dass die privaten oder auch die sogenannten gemischtwirtschaftlichen Betriebe rationeller betrieben werden könnten als die Regiebetriebe, ist durchaus nicht erwiesen und hält einer objektiven Prüfung auch nicht stand. Es steht vielmehr fest, dass das Wirtschaftsergebnis gutgeleiteter Regiebetriebe dem gleichartigen Privatbetriebe mindestens gleichsteht.' Ibid., p. 129. National Conference of Gas, Water, and Electricity Workers, unanimous resolution, 1922.

such different views on the matter, it is a little difficult to come to a definite conclusion about the real merits of the principle of mixed management. Perhaps the existence of these conflicting views is to be partly explained by the probability that the private industrialist sees in mixed management nothing but modified public management, while the local government official regards it as modified private management. It would moreover seem that either view may, according to circumstances, be correct. For although the details may vary from case to case, the general principle remains unalterable that either the private or the public interest must in the last resort have the casting vote in the management of a mixed undertaking—unless, indeed, the representation is so evenly balanced that a deadlock is arrived at on all controversial issues. If this casting vote is held by the private interest, it is difficult to believe that the mixed undertaking will have any important general advantage over the ordinary controlled private undertaking. If, on the other hand, this casting vote is held by the public interest, it would seem that the mixed undertaking may have some advantages over the ordinary publicly managed undertaking, but that these advantages are not necessarily so certain or so great as has often been assumed. There is, for instance, something to be said for the view that the mixed undertaking need not be so bureaucratically organized as the public undertaking usually is, although such views as those quoted on pp. 8–9 must not be ignored. Again, it is probable that the financial organization of the mixed undertaking will resemble that of the private rather than that of the public undertaking, which is a definite economic advantage. The case for the absence of political influence is much weaker, although the minor oscillations of party politics are perhaps not so likely to make themselves felt as under direct public management. The mixed undertaking has, however, one indisputable advantage over the public undertaking in the greater opportunity it gives for overstepping local government boundaries.[1]

Sometimes an attempt to prevent deadlocks on matters of first importance is made by reserving certain powers to one or other party in the mixed undertaking. Thus a recent writer on the subject has suggested 'that the power of management should be divided between the public authorities and the private shareholders as follows: to the private parties a preponderance in the commercial and technical management of the business; to the public parties the right, if not of imposing new decisions, at least of placing obstacles in the way of new departures in essential particulars affecting the public interests, of which such parties are the representatives and guardians in the undertaking'.[1] And the organizing authorities of the 1930 Conference of the International Union of Local Government Authorities were of the opinion that, 'as representing public interests, public authorities ought to have, at least in certain respects, more power than the ordinary shareholders of a commercial concern, so that they may be able to enforce their wishes and prevent action contrary to general interests'.[2]

---

[1] Even the otherwise uncompromising reports in the symposium on *Die Regiebetriebe der Gemeinden* contain one or two concessions on this point.

An interesting example of this kind of compromise organization is provided by the Deutsche Gas-Gesellschaft, an account of which was given in the report of the German Union at the above-mentioned conference.[3] The shareholders of this company are the Berlin suburbs of Teltow and Niederbarnim and the Continental Gas-Gesellschaft. The company takes the form of a 'twin company', i.e. it consists of a holding company and an operating company. One-third of the capital of the holding company and two-thirds of that of the operating company is private; the rest is held by the municipalities. Questions of tariffs, extensions, contracts, and the like, are dealt with by the holding company. This form of organization is said to have been successful; but it does not escape the difficulty which must attend all such attempts at delimitation of powers—the difficulty that so far as they achieve their immediate object they introduce all those difficulties associated with the drafting of long leases which form one of the principal objections to a system of regulated private management. It is true that the mere presence of representatives of opposing interests on the secret councils of an undertaking may well act as a sort of brake on the extremer policies of the majority. But the good results of this are likely to be counterbalanced by the bad, since the brake is just as likely to be applied to desirable as to undesirable projects.[4] And in the long run no such brake would be able to prevent a policy from being carried through by a determined majority.

---

[1] M. Chéron, 'De l'Actionnariat des collectivités publiques', quoted in *Report of Annual Conference of International Union of Local Authorities*, 1930, p. xvi.

[2] Ibid., p. xvi.

[3] Ibid., vol. ii, p. 192.

[4] 'Alles gemischtwirtschaftliche hat einen hinterhältigen Charakter; denn hier ist nicht der Betrieb an sich die Seele, sondern der Kampf zwischen privat-

It would indeed appear that the mixed undertaking is not essentially a mixed form at all, but in practice always a somewhat fettered (and therefore in certain ways a somewhat improved and in other ways a somewhat weakened) public or private undertaking. But it may nevertheless have a definite sphere of utility where certain possible combinations of circumstances make public operation desirable but impracticable.[1] The most important of these occasions are (i) when the undertaking invades the geographical territories of two or more public authorities, and (ii) when the financial demands of the undertaking exceed the capacity of the public authority wishing to control it.

The importance of mixed management for inter-district undertakings has been greatly increased by recent advances in the technique of gas and electricity distribution, which have greatly increased the size of the most economic geographical unit in the industries concerned, giving rise to the growth of such gigantic concerns as the 'R.W.E.',[2] the 'V.E.W.' (Vereinigte Electrizitätswerke Westfalen), and the Ruhrgas A.G.

Mixed management or at least mixed responsibility for capital may be the only basis upon which a public authority can take part in the operation of undertakings whose financial demands are unusually heavy.[3] The German Union of Local Authorities holds

---

wirtschaftlichem Einfluss und der Machtsphäre der öffentlichen Hand.' A. Moeglich, *Die Regiebetriebe der Gemeinden*, p. 43.

'Die Behauptung, dass die gemischtwirtschaftlichen Betriebe die Vorzüge der kommunalen und privaten Betriebsführung miteinander vereinen, ist eine leere Behauptung, die niemals bewiesen worden ist. Die Wahrscheinlichkeit spricht vielmehr dafür, dass die Nachteile beider Formen sich geltend machen werden, und dass, wenn nicht der eine Partner eine überlegene Stellung besitzt, ein ständiger Kampf um diese Position zwischen den beiden Beteiligten sich abspielen wird. Es kann nicht ausbleiben, dass die privaten Profitinteressen und die öffentlichen Interessen, die ganz anderer Natur sind, miteinander in Konflikt kommen.' Professor Lindemann, ibid., pp. 28-9.

[1] Even some of the contributors to the symposium on *Die Regiebetriebe der Gemeinden* admit that the mixed undertaking may have its uses in such circumstances. 'Gemischtwirtschaftliche Betriebe scheinen mir nur unter ganz bestimmten Bedingungen zulässig zu sein. Dahin gehören z. B. der Besitz von Kraftquellen durch die Privatindustrie, wie im Ruhrgebiet, der Besitz solcher Versorgungswerke selbst, deren Kommunalisierung angestrebt werden soll, usw.' Professor Lindemann, op. cit., pp. 28-9.

[2] See pp. 34 ff.

[3] 'Where there has been joint action or partnership—in other words, a mixed undertaking—it has generally been the case that pressure of local circumstances,

the opinion that this is often the case with small towns,[1] but even in small towns it is doubtful if the situation need arise in normal times with recognized *public-utility* enterprises. That it may arise even in big towns with other forms of public trading which involve greater risk is an undeniable fact which does not bear directly upon the present discussion.

Full scope is allowed by German law for the various forms of management discussed above. It has already been stated that the law does not prescribe whether local utilities are to be organized as monopolies or as competitive concerns. It similarly refrains from prescribing whether they are to be publicly or privately operated. In theory, anybody may conduct tramway, water, gas, or electricity enterprises, subject only to the same general safeguards that control the conduct of other businesses. In practice, however, this general power is much restricted by the fact that these enterprises cannot usually be carried on without the use of the public streets. A would-be entrant into any such business has therefore to obtain permission to use the streets from the municipality or other responsible body; and therefore the municipality has in practice the power of deciding not only whether the operation shall be competitive or monopolistic, but also whether it shall be municipal or private.

Dr. Karl Friedrichs in his useful little book on *Das Recht der Versorgungsbetriebe*[2] distinguishes from the legal point of view the following seven possible attitudes of municipalities with regard to the local utilities in their areas:

'1. The municipality permits a private undertaker to use the public streets and squares for the laying of pipes, &c., in return for the assurance of benefits for the municipal treasury or the inhabitants, with or without reservation of the right of reversion after the expiration of a long period, and with or without compensation.'

'2. The municipality establishes and operates the undertaking.'

---

usually of a financial nature, has brought about the amalgamation.' Sir W. Hart in *Report of International Union Conference*, 1930, vol. ii, p. 64.

[1] 'Für die kleineren Gemeinden ist es aus finanziellen Gründen nicht möglich, eigene Gas- und Elektrizitätswerke anzulegen, ausserdem fehlen ihnen jegliche Erfahrungen in der Führung solcher Betriebe, so dass sie sich mit Vorliebe an Überlandwerke, die vielfach in Händen von Privaten stehen, anschliessen und so die Versorgung gemischtwirtschaftlich betreiben.' Report of German Union of Local Authorities, ibid., p. 204.

[2] Berlin-Friedenau, 1928, pp. x + 92.

'3. The municipality guarantees a fixed dividend to a private company.'

'4. A mixed undertaking in the economic sense exists when the property of municipalities and private capitalists is devoted to a common end.'

'5. The municipality forms (or a number of municipalities form) a company (joint-stock or limited) whose shares are held exclusively by itself (or themselves).'

'6. The municipality purchases the local-utility service from an existing undertaking and sells it again to consumers.'

'7. The municipality permits an outside municipal undertaking to operate in its area, in return for compensation.'[1]

These seven possibilities may be reduced to three, if the first and third be reckoned as equivalent from the economic point of view, and the second, fifth, sixth, and seventh as also equivalent.

The first and third—the adoption of private operation—involve the grant by the municipality of a 'concession', by which the exact relationship of the municipality to the undertaking will be defined, and the exact terms of which will depend on little else than the relative bargaining powers of the two parties. An alternative method is for the municipality to establish and own the undertaking, leasing it to a private undertaker for a definite period. In this case, the contract of lease will take the place of the concession, the rent will take the place of the payments for the use of the streets, and the situation in general will in fact not differ essentially from that of private management under a concession.

Where a municipality decides for public management, whether in the second, fifth, sixth, or seventh form set out above, no special formalities or sanctions are usually necessary.[2]

A study of the manner in which these various legal possibilities have been exploited in practice demands at least a brief survey of the history of German public-utility management. Such a survey forms the subject of the next chapter.

Solutions of Problem III.

The *logical* priority of the question of total profits is sometimes obscured by the fact that 'fair' prices are often fixed and the regulated undertaking left to earn what profits from them it can.

---

[1] Op. cit., pp. 5-7.

[2] But municipalities usually need special powers for borrowing.

'Fair' prices, however, never means anything but those prices that will give a 'fair' profit, and thus the idea of permissible profit always dominates the idea of permissible charges, in fact if not in appearance.

But, as has already been said, it is not easy to determine exactly what constitutes a fair profit. The ideal has been well expressed by Professor Glaeser in the following terms: 'The rate of return should be high enough but not higher than is necessary to attract capital and the necessary managerial ability into the industry and to hold it there.'[1] In practice, however, this rule is more useful as a canon of postliminious criticism than as a guide to action.

A fresh element of doubt is introduced into this problem when the undertaking is to be publicly operated. It is often argued that in such cases no profit at all should be made. At the 1926 Conference of the Institute of Public Administration, for example, the view which seemed to commend itself generally was 'that where the capital is borrowed on the security of the rates (and the same applies to guarantees by the Exchequer) the utility service should contribute out of surplus at least the difference between the actual interest charge and what it would have been had no such security or guarantee been given. Subject to that, the preference of the Conference seems to have been for providing service at cost.'[2] But there are important arguments against this point of view.

German law makes no special provisions concerning the amount of profit that may be made from public-utility undertakings, apart from the rule that publicly operated undertakings must not be run at a loss.

No exact comparisons between the profits of public and of private management in the public-utility industries is possible, because the methods of book-keeping in use are so varied. There can be little doubt that municipalities do seek to make profits from their gas, electricity, and tramway undertakings, and even in some cases from their water undertakings. This tendency was already observable before the War and post-war financial difficulties appear to have greatly strengthened it even in cases where the municipality would as a matter of principle prefer to supply utility services at cost. The following table shows the profits made in the twenty-eight largest German cities in the year 1929. Its value for purposes of comparison with tables of private industrial profits is greatly restricted by the fact that the amounts stated include payments for the use of public streets and similar items of what would be reckoned as 'expense' and not 'profit' in private undertakings. But it is possible to use it as a basis for some interesting inter-industrial comparisons.

---

[1] M. G. Glaeser, *Outlines of Public Utility Economics*, p. 414.

[2] *Public Administration*, 1926, vol. iv, pp. 284-5.

TABLE I[1]

Profits of German Publicly Operated Utility Undertakings, 1929

	PROFITS IN 1,000 REICHSMARK			
City	*Water*	*Gas*	*Electricity*	*Transport*
Berlin	3,881	—	28,703	34,373
Hamburg	+	+	—	—
Cologne	4,405	5,711	15,419	3,601
Munich	2,255	2,100	7,355	827
Leipzig	8,540*	*	*	401
Dresden	610	4,038	3,450	1,605
Breslau	1,975	4,986	9,005	1,451
Frankfort	1,991	—	7,599	3,482
Essen	836	1,626	—	—
Dortmund	605	—	2,550	525
Düsseldorf	302	13,378*	*	—
Hanover	2,918	3,382	5,951	—
Nuremberg	1,011	2,247	4,128	830
Stuttgart	+	+	+	—
Chemnitz	310	2,204	7,266	320
Gelsenkirchen	—	712	—	—
Bremen	+	+	+	—
Magdeburg	1,102	1,247	6,437	—
Königsberg	452	1,425	2,734	1,528
Duisburg	888	1,189	2,873	—
Stettin	829	981	—	—
Mannheim	195	1,050	2,042	0
Altona	3,100*	*	2,527	—
Bochum	469	743	1,158	—
Kiel	+	+	+	—
Halle	150	935	2,595	1,010
Barmen	5,000*	*	—	500
Elberfeld	75	1,375	—	—

— Undertaking not publicly operated.
+ No returns available.
* Figures relating to more than one column combined.

Solutions of Problem IV.

The fourth problem, which has already been referred to as lying at the heart of public-utility regulation, is that of controlling the differentiation of prices.

---

[1] From the *Statistisches Jahrbuch deutscher Städte*, 1930, pp. 186 f.

In general, German law leaves local government authorities free to determine the prices for water, gas, or electricity supplied by their own undertakings, and to make such conditions respecting the charges of private undertakings as the undertakers can be induced to accept. The charges of tramway undertakings, whether municipal or private, are subject to government supervision under the law relating to light railways; but this supervision, since it concerns itself with the general level and not with individual variations of fares, is a contribution to the solution of the third rather than of the fourth problem of control.

A study of the ways in which this fourth problem has been solved in actual practice in Germany forms the subject of Chapters IV–XI of the present work.

FURTHER READING ON CHAPTER II

INSTITUTE OF PUBLIC ADMINISTRATION: *Public Administration.* (See note on Chap. I.)

Special reference should be made to the papers on 'Appropriate Authorities' by Sir J. Broodbank (pp. 309-17), C. D. Burns (pp. 318-29), Sir G. Clarke (pp. 330-7), and W. Moon (pp. 338-51), and on 'The Finance of Public Utilities' by R. G. Hawtrey (pp. 352-9), C. W. Hurcomb (pp. 360-76), J. R. Johnson (pp. 377-88), and J. L. Mackenzie (pp. 389-97).

PASSOW, R. *Die gemischt privaten und öffentlichen Unternehmungen.* Gustav Fischer, Jena, 1912, pp. vi + 220.

This remains the standard work on mixed undertakings. It deals (i) with the most important early examples (up to 1912), and (ii) with their outstanding common characteristics synthetically considered. A reprint was issued in 1923.

PIGOU, A. C. *The Economics of Welfare.* Macmillan, London, 1929. Special reference should be made to Part II, chaps. xx-xxii (pp. 329-407).

VERBAND DER GEMEINDE- UND STAATSARBEITER: *Die Regiebetriebe der Gemeinden.* Schlesische Strasse 42, Berlin S.O. 33, 1927, pp. 133.

This little book contains a series of answers by 'leading administrative and technical experts' to a questionnaire relating to the relative efficiency of public and mixed management of local utilities. Reference may also be made to *Die Regiebetriebe der Gemeinden: Eine Kritik,* by H. Ludewig, Julius Springer, Berlin, 1927, pp. 60, which accuses the editors of the first publication of a 'personal interest as it were' in the dissemination of biased views on the question of municipalization; and to *Noch Einmal: Die Regiebetriebe der Gemeinden: die Kritik einer Kritik,* V.d.G.u.S., Berlin, 1928, pp. 63, which replies with a *tu quoque.*

CHAPTER III

THE HISTORY OF PUBLIC-UTILITY MANAGEMENT IN GERMANY

THE history of the four local utilities in Germany up to 1930 may, with individual modifications, be divided into two stages—the first, one of controlled private operation; the second, one of public operation. The latter stage may be divided into a stage of purely public operation and a stage of experiment with various compromise forms of management.

These divisions represent general tendencies only. At no time has the management of any German local-utility industry been either entirely private or entirely public, although the water-supply is at present almost entirely in public hands. Furthermore, the various stages of development begin and end at different dates in the different industries. The history of the management of the local utilities in the twenty-eight largest German cities may be summarized as in the following table:

TABLE II

History of Public-Utility Management in twenty-eight largest German Cities[1]

	INDUSTRY			
	Water	*Gas*	*Electricity*	*Tramway*
Period of private management	—	1830–69	—	1870–1909
Period of public management	1850–1919	1870–1919	1890–1919	1910–29
Period of compromise forms	1920–30	1920–30	1920–30	1920–30

Various interesting facts may be learned from this table.

1. It will be observed that, unlike the gas and tramway industries, the water and electricity industries in the twenty-eight cities have not passed through periods of private management. From the time when central waterworks first began to be built—that in Leipzig dates back to the Middle Ages, but most cities had to wait until the 'sixties and 'seventies for their modern supplies and

---

[1] See p. ix, note.

some did not obtain theirs till the 'eighties—the industry was chiefly in the hands of the municipal authorities; indeed, from 1894 till 1922, of the twenty-eight water-supply undertakings dealt with in the above table, twenty-seven were publicly operated. Since 1922 the principle of ordinary public management has been abandoned in certain interesting cases, however, a development that has been simultaneously paralleled in the other three local utility industries.

The electricity-supply industry also has been preponderantly in public hands, almost from the first, although not to anything like the same extent as the water-supply industry. It is true that the first two electricity undertakings to be established were private concerns—those in Berlin (1883) and Stettin (1885). But by 1889 these were outnumbered by the municipal undertakings of Elberfeld, Barmen, and Königsberg, and municipal undertakings have been in a majority ever since. In 1926 not a single electricity undertaking in the twenty-eight cities remained in private hands.

2. It will further be observed that although the gas-supply and tramway industries have each passed through three stages of development, they have entered upon the first two of these stages at quite different dates. The gas industry was the first to be established. Coal-gas was first used for lighting in England in 1797. In 1826 concessions were given to English firms for the erection and operation of the first German gasworks, in Hanover and Berlin; and, by the end of the 'forties, fourteen of the twenty-eight cities had central gasworks. Of these, eleven were privately operated and three publicly operated. The privately operated undertakings remained a majority until the early 'seventies.

The tramway industry was the next to be established. The world's first modern tramway was opened in New York in 1832, and the first European tramway in Paris in 1855. In 1864 the first German tramway was opened in Hamburg by the private 'Pferdeeisenbahngesellschaft'. In the following year another was opened in Berlin. By 1880, sixteen of the twenty-seven[1] cities had tramways; by 1893, twenty-one. All of these tramways were private concerns. Private operation remained the ruling type in the industry till just before the Great War, when it gave place to public and mixed management.

---

[1] Hamburg and Altona, which have a common tramway system, are considered as one city here.

Such figures and records as are available would suggest that the tendency to municipalization began with the larger cities. The dates given above in Table II must therefore be reckoned as somewhat too early for the industries as a whole; but the relative order of the various periods remains unaffected.

THE PERIOD OF PRIVATE OPERATION

This may very roughly be regarded as belonging to the middle of the nineteenth century for the gas industry and to the end of it and beginning of the twentieth century for the tramway industry. Perhaps the motives and methods that characterize this period may best be interpreted by brief sketches of the history of some typical undertakings.

For the first two decades of the nineteenth century, Germany was not in a financial position to make use of the recent English invention of street-lighting by gas, and the first gasworks in Germany were built by an English company, the Imperial Continental Gas Association. In 1828, it is true, a German scientist named Blochmann built a gasworks for Dresden and in 1838 for Leipzig. But Dresden and Leipzig remained for several years the only German cities which themselves undertook the business of gas-supply. For even when the financial situation had so far improved as to enable them to dispense with foreign assistance, the municipalities still preferred to leave the operation if not the ownership of their gasworks to private enterprise. There were two obvious reasons for this. The first was the fact that the industry of gas-supply was still too young for political and administrative theorists to have decided whether it properly came within the sphere of municipal enterprise or not. On the whole, they inclined to the opinion that it did not. The lighting of the streets had long been an admitted public duty; but this formed an increasingly unimportant part of the business of a gasworks, and there existed no precedent for supposing that the supply of gas to private consumers was a public duty like that of supplying water. And in the second place, the public authorities were in any case loath to commit themselves to undertakings that called for a great deal of expert knowledge (such as few people outside England possessed at that time) and that demanded a large capital outlay attended by a considerable degree of risk. It is interesting to note that the water-supply industry, which passed through no period of private operation, is one which (on grounds of public health) had almost always been recognized as a 'public' industry, and one whose demands both for new technical ability and for speculative financial support are much more modest than those of the gas-supply industry.

It is not surprising therefore that during the period in which the gas industry was gaining a footing in Germany most of the larger cities preferred to leave it in the hands either of the Gas Association or of some other company, and private gasworks were established during that period in Frankfort, Cologne, Elberfeld, Hamburg, Stuttgart, Breslau, Nuremberg, and Munich. It was not until about 1850 that the larger cities began seriously to consider the operation of gasworks themselves. The pioneer, excluding of course Dresden and Leipzig, was the city of Stettin, which in 1837 had passed a resolution that arrangements should be made for lighting its streets with gas, 'since it is desirable that the public should be given the benefit of this new invention, even if gas-lighting should work out somewhat more expensive than oil-lighting'. Stettin first approached the Gas Association, but the Gas Association did not consider their proposition sufficiently tempting and postponed discussion of it until the city at last determined to build and operate the works itself provided that sufficient money could be borrowed for the purpose. A loan of 250,000 Thalers being successfully floated, the works was built (by a son of the scientist Blochmann, who was unable to undertake the work himself owing to his occupation with similar schemes elsewhere), and was in operation by 1848.

The example set by Stettin was soon followed by other cities—notably Königsberg, Magdeburg, Bremen, Bochum, Kiel, and Halle. And in 1857 a new fashion was set by the municipalization of the Berlin gasworks, which had been in private hands for thirty-one years. Fresh private works continued to be built, however—in Duisburg, Mannheim, Altona, Essen, Dortmund, and Gelsenkirchen—and it was not until 1873 that the majority of the gasworks in the twenty-eight cities of our investigation were in public hands.

The Halle Tramways were typical of the early history of their industry. In 1880 the city sent a deputation to inspect the tramways already existing in Cassel, Frankfort, Wiesbaden, Elberfeld, Hanover, Brunswick, and Cologne, and after receiving a favourable report decided to have a horse-tramway built in Halle. In 1882 a thirty-five-year concession was granted to a private firm, which constructed and operated two lines. From 1883 onward this tramway was operated by a company, the 'Hallesche Strassenbahn A.G.', or 'Red Tramway' as it was popularly called to distinguish it from the competing 'Green Tramway' or 'Stadtbahn Halle', which was granted a concession in 1888. In 1891 the Green Trams were electrified and gradually drew custom from the Red Trams until they too were electrified in 1899. The Red Trams remained a private undertaking until 1911, when they were bought out by the city. The Green Trams also were bought out in 1917, and from that date the two systems were unified as the 'Städtische Strassenbahn'. By then, very few of the tramways in the larger cities remained in private hands; most had changed ownership before the War.

Of the twenty-seven tramways in the largest cities, twenty-four were started as private concerns. The remaining three were all built towards the end of the century—i.e. they were among the last to be built in these cities. As in the gas industry, it was the formation of new public enterprises that paved the way for the municipalization of existing private enterprises. It is interesting to note that municipalization appears to have become common immediately after the short period during which most undertakings substituted electrical for horse traction.

As has already been stated, the electricity-supply industry in the twenty-eight cities cannot be considered to have passed through a period of private management at all, since almost from its first beginnings the publicly managed undertakings have been in a majority. But this majority was, until the end of the century, a very small one, and it would be a grave omission to ignore the part that private enterprise played in the establishment of the electricity industry in the larger German cities. In the smaller cities, which do not come within the range of the above table and figures, private enterprise has naturally played a still larger part.

Eighteen of the undertakings in the largest cities were established during the decade 1890–1900, five before, and five afterwards. The first two were private (Berlin and Stettin). The rest were in about equal numbers private and public. A typical undertaking was that in Chemnitz, which was erected at the cost of the city by Siemens and Halske in 1893–4 and, after being operated for a short time by the city itself, was leased to a private firm for ten years. At the end of the period of the lease it was taken over by the city again and has been publicly managed ever since.

The extent of private operation in the four industries may be seen from Diagrams I–V. Perhaps the most interesting conclusions to be drawn from the facts thus presented are those respecting the extent to which private enterprise has been responsible for building up the various industries. The following table compares the number of undertakings that were privately operated when first established with the number that were publicly operated:

TABLE III

Original Form of Management of Public Utilities

	NUMBER OF UNDERTAKINGS IN 28 LARGEST GERMAN CITIES		
Industry	*Private*	*Public*	*Both*
Water-supply .	4	24	28
Gas-supply .	19	9	28
Electricity-supply	13	15	28
Tramway . .	24	3	27
All . . .	60	51	111

It is also interesting to note that the average[1] length of the period of private operation in undertakings that were established as privately operated concerns[2] in the twenty-eight cities is as follows:

TABLE IV

Average Period of Private Management of Public Utilities

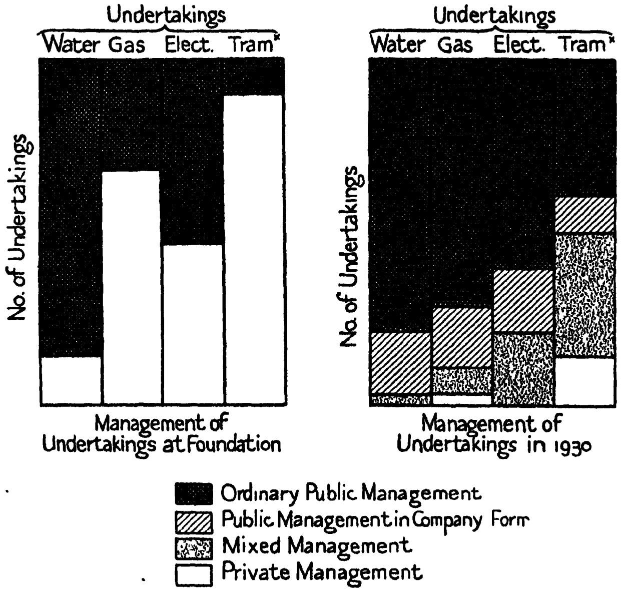
Industry	*Average number of years of private operation*
Water-supply . .	25
Gas-supply . .	40
Electricity-supply .	12
Tramway . .	42
Average . .	33

---

[1] These averages have been calculated in the same way as averages of cricket scores are calculated, i.e. the aggregate number of years of private operation of all the privately established concerns has been divided by the number of such concerns that have *ceased to be* privately operated.

[2] The converse case, i.e. that of undertakings which were established as public undertakings and later either leased or sold to private operators, is rarely met with. The only examples in the field dealt with above are the electricity undertakings in Chemnitz and Königsberg.

DIAGRAM I. CHANGES IN THE MANAGEMENT OF PUBLIC UTILITIES IN 28 GERMAN CITIES



*Tramway in Hamburg and Altona reckoned twice

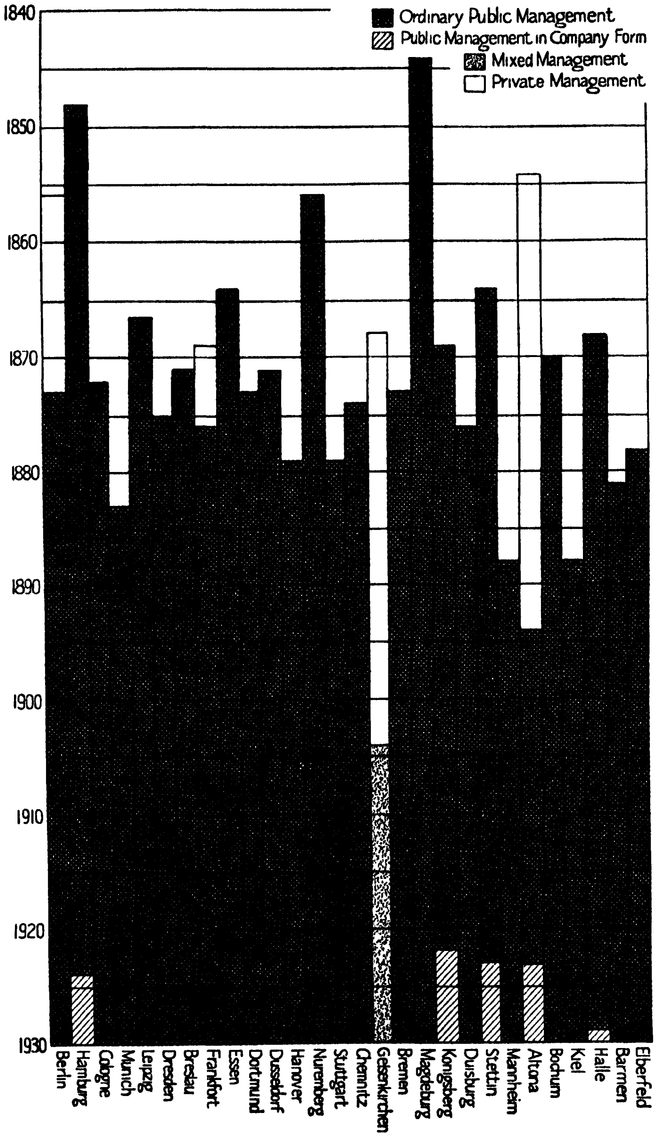


DIAGRAM II. History of the management of water undertakings in 28 German cities.

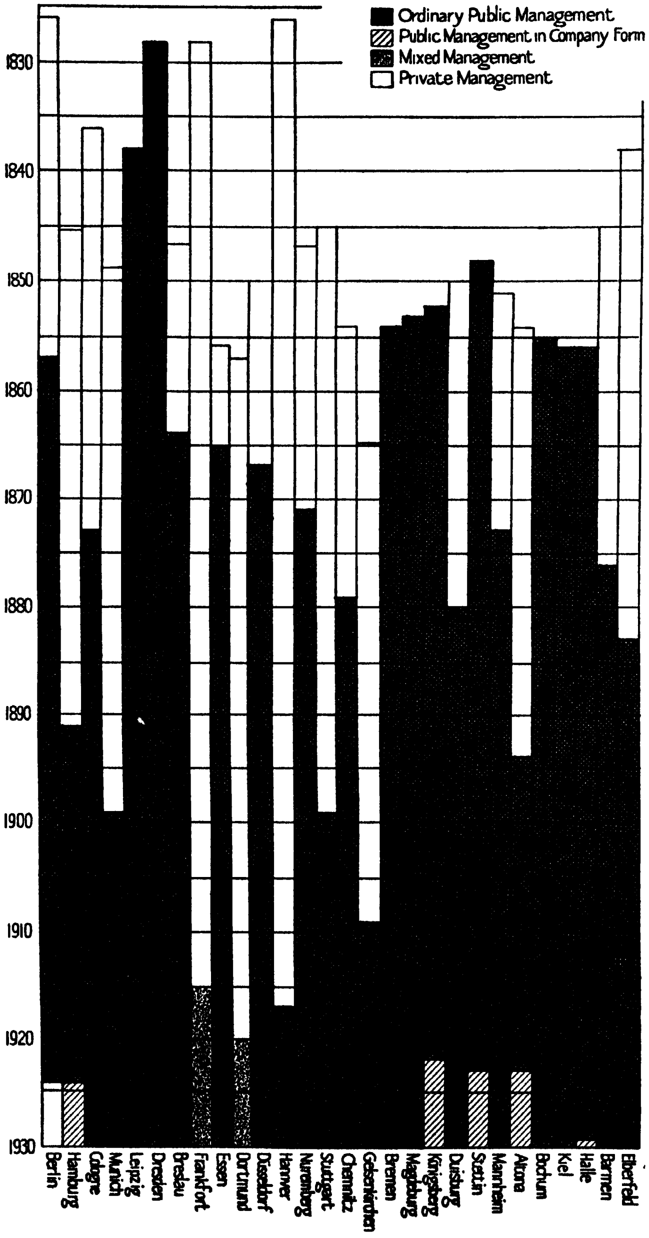


Diagram III. History of the management of gas undertakings in 28 German cities.

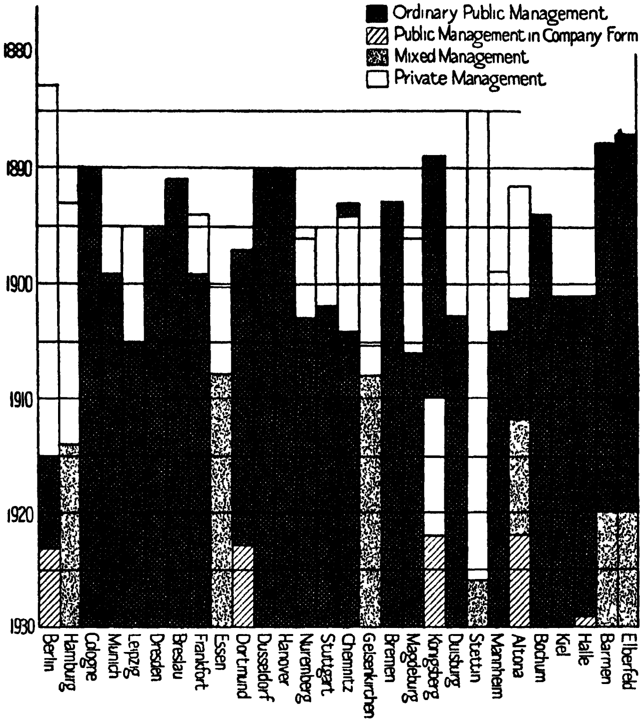


Diagram IV. History of the management of electricity undertakings in 28 German cities.

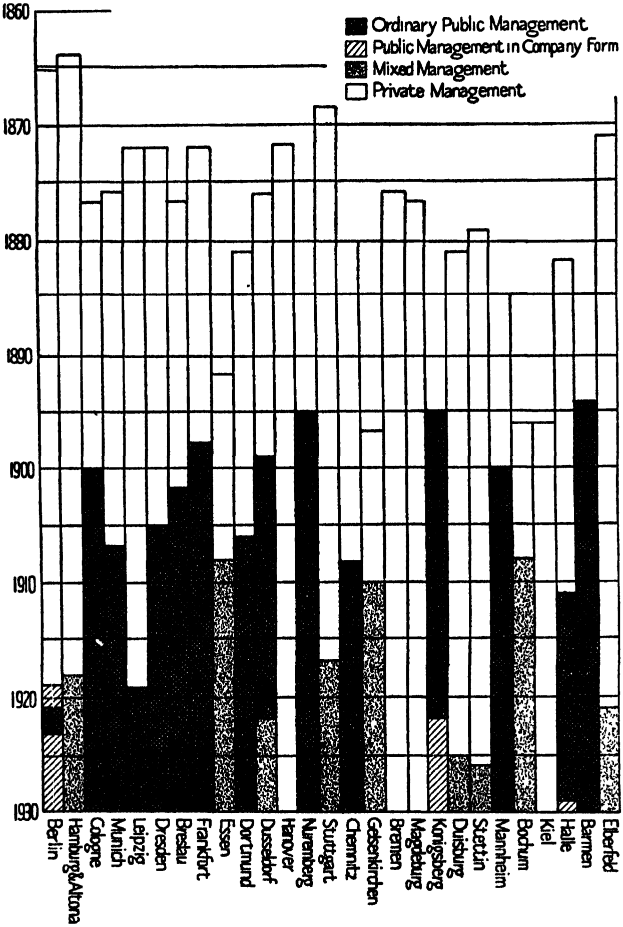


DIAGRAM V. History of the management of tramway undertakings in 28 German cities.

THE PERIOD OF PUBLIC OPERATION

It has already been pointed out that the industry of central water-supply had, from its beginnings, always been to a very large extent in the hands of the public authorities in Germany. The chief reasons for this early municipalization are: (i) the business of water-supply has long been recognized as one that is of special importance for public health and one therefore in regard to which the public authorities have special duties; and (ii) the business of water-supply is a comparatively simple one whose technical and financial demands have not usually exceeded the capacities of at least the larger municipalities.

The history of water-supply in Stettin is typical. From early times different parts of the city had been provided with fountains. The castle, when it was rebuilt in 1577, was supplied with fresh water which flowed through wooden pipes from a spring in the hills outside the city. The city itself was supplied from one or two independent springs and this supply was extended and improved from time to time. In 1732, by special favour of the King, a new mile-long aqueduct was built, to bring water from the Warsow Hills to a fountain in the market-place and one or two private houses in the neighbourhood, but this aqueduct was destroyed in 1813 at the time of the Prussian siege. At that time two other large fountains also supplied the city with rather unsatisfactory water from the Oder.

This situation left much to be desired. As early as 1826 the city began to consider projects for a central water-supply, but nothing was done until in 1861 the design for a works was made the subject of a competition which was won by a German. The works was built in 1863–5, and was, according to the report of the engineer, the first works in Germany to be built by a German and not by an Englishman. In 1865 the population of 72,000 was supplied with 245,000 cubic metres of water from the central works—the average consumption per head being at the present day about ten times as great as the quotient of these two numbers.

By 1870 eleven other central waterworks were already in existence in the twenty-eight cities, four privately established and seven publicly. After that date no other private waterworks were established in the twenty-eight cities, and the four existing private concerns were all eventually either municipalized outright or, in one case, converted into a 'mixed' undertaking by the purchase of some shares by the municipality (Gelsenkirchen).

It would appear that outbreaks of cholera and other diseases were frequently the final causes that decided municipalities to introduce modern methods of water-supply. The connexion between infectious diseases and bad water-supplies does not appear to have been generally recognized until the 'sixties or thereabouts, i.e. until a few cities had built central waterworks and been observed to escape the ravages of subsequent epidemics.[1]

The electricity industry, like the water-supply industry, was preponderantly in public hands from its beginning. But it differed from the water-supply industry in that, although the industry as a whole could not be said to have passed through a stage of private operation, many of its constituent undertakings did so. The two remaining local utilities, the gas-supply and tramway industries, differ still more from the water-supply industry, in having passed through initial periods in which the majority of their constituent undertakings were privately operated. Nevertheless, after a time it began to be evident that private management in these industries also was not entirely satisfactory. The chief objections that were made to it were: (i) that no method could be discovered of preventing the private undertaking from using its monopolistic powers either (*a*) to rest on its laurels and perhaps become inefficient or, alternatively, (*b*) to obtain profits in excess of those which it had been the intention of the regulating authority to allow it; and (ii) that extensions which were socially desirable would not be willingly undertaken by private enterprise unless they promised to be remunerative.

A strong movement therefore set in for the conversion of private into public undertakings. This movement first became noticeable in the gas industry, which was the first of the four local utilities to be established in Germany. The history of the gas undertakings in Breslau is typical. The first gasworks in this city was erected in 1847 by a private company for the purpose of supplying the central part of the city. As new suburbs were built, demands for gas came from outlying districts also, and these demands the city itself determined to meet, having experienced some of the disadvantages associated with controlled private enterprise. Public operation was rendered all the more attractive an alternative by the fact that since the 'twenties a body of engineering experts had gradually been formed in Germany, so that it was now quite possible for municipalities to secure the services of capable directors and managers. Furthermore, the industry had advanced beyond the experimental stage and had become a safe field for investment. Several big gasworks had already been publicly established in other large cities. And Berlin had created a precedent for municipalization of gasworks that had been privately established. Breslau, having therefore decided to supply the suburban demand itself, built a works for that purpose in 1864, and seven years later took over the private concern as well, thus bringing the whole supply under public management.

---

[1] For a case in point see *Werke der Stadt Halle Aktiengesellschaft, Denkschrift 1, September 1929*, pp. 50 and 53.

The desire to provide satisfactorily for extensions seems to have been the principal reason for the municipalization of gas undertakings in the twenty-eight cities, apart from such cases as that of the undertaking in Hanover, which was the oldest gas undertaking in Germany, had been built by an English firm at the time of the personal union of the crowns of England and Hanover, and was to have remained in English hands until 1950, then to be transferred to the city. But the War upset this friendly arrangement and the city acquired the undertaking in 1917.

The electricity undertaking of Chemnitz has already been cited as one whose rapid abandonment of the principle of private operation makes it typical of a large section of the industry. The city's chief reason for not renewing the lease in 1904 seems to have been a desire to exercise direct control over extensions of the plant. The history of the undertaking in Stuttgart is similar. The 'Edison-Gesellschaft' first 'drew the attention of the city council to the uses of electricity' in 1883. By 1891 the city had definitely decided to obtain an electricity supply but was uncertain whether public or private operation would be preferable. Already the experience of gas and tramway undertakings was becoming responsible for the growth of an additional motive for municipalization—the belief that the public acquisition of a prosperous undertaking might be profitable for the ratepayer as well as safer for the consumer. Influenced perhaps by this motive, as well as by the desire to control future developments, the city decided to have its electricity supply introduced by private enterprise and taken over by the public when the initial difficulties of construction and commencement of supply had been solved. A concession was therefore granted to the firm of Schuckert & Co. to construct and operate a central supply station. The construction began in 1894, and less than a year later the first supply of current was given, to the tramways. Almost from the beginning the demand for electricity exceeded the supply. Certain extensions followed, but the private undertaker refused to incur the expense of all the extensions that were desirable unless his concession were lengthened. The city, instead of lengthening the concession, purchased the undertaking by arrangement in 1902.

The desire to control extensions is most discernible as a motive for municipalization in the tramway industry, however; because here to the advantages of municipal management were often added the advantages that would arise from the unification of two or more existing competitive undertakings. This was one of the principal reasons for the purchase by the city of Halle of the 'Red' and 'Green' tramways in 1911 and 1917 respectively. It was similarly one of the reasons for the successive purchases by Vienna of the 'Bau- und Betriebsgesellschaft für städtische Strassenbahnen' (1902), of the 'Neuer Wiener Tramway' (1902), of the lines belonging to Messrs. Ritschl & Co. (1904), of the Steam Tramway (1907), and of others in later years.

Municipalization may be considered to have become a fairly established feature of the German gas industry by 1870 and of the tramway industry by 1910. From these dates—and from the dates of the foundation of the water and electricity industries—the local utilities have been increasingly public rather than private concerns in Germany. 'Before the War, that is to say, at a time when political considerations did not play such a large part as they now do, undertakings were being everywhere municipalized. Existing contracts with concessionaires were not renewed on expiry; such contracts were often prematurely terminated, sometimes with great sacrifice on the part of the public authority. For new undertakings public management was a matter of course. Immediately before the War there was scarcely a single waterworks that was privately operated, the gasworks had to a great extent passed into the ownership of the municipalities, and the electricity works also were being more and more municipalized.'[1] As has been said, the motive at first appears to have been a certain dissatisfaction with private enterprise, coupled with the discovery that the industries, once established, were not difficult to operate. In later years—from about 1900 onwards according to Dr. Gerber—this motive seems to have been reinforced by the desire on the part of public authorities to extend their influence over industry, no longer merely for the protection of the consumer, but in order to earn profits for the relief of the rates also.

---

[1] Pichler, *Die Regiebetriebe der Gemeinden*, p. 80.

The movement towards public operation has continued to the present day. But since the War it has been modified in a most interesting fashion.

THE PERIOD OF EXPERIMENT WITH COMPROMISE FORMS OF MANAGEMENT

The tendency of German local authorities to regard the four local public utilities as correct subjects for direct public operation appears to have continued at least in the larger cities until the present day. But an attitude of compromise, which began as early as 1908 but did not become really important until after the War, has given rise to many interesting problems. This development of the 'mixed undertaking' and 'public management in company form' is worthy of special study, not merely for its own sake, but also for the light which it sheds on the broad problem of Public versus Private Operation.

Germany has rightly been called the classic country of the mixed undertaking.[1] The Chief Burgomaster of Wesermünde, summarizing the reports presented at a recent conference on mixed undertakings,[2] distinguished five stages in their development in Germany, viz. a pre-war stage of experiment, a stage of growth during the War, a stage of fresh experiment immediately after the War, a stage of sudden renewed growth during the period of currency inflation, and a recent stage of decreasing popularity caused by the discovery of new compromise forms. We may consider these stages in order.

I. *The Period of Experiment, 1908–14*: 'In rapid succession', wrote Dr. Passow in 1912, in his standard work on mixed undertakings,[3] 'especially during the last two years, one mixed private and public undertaking after another has arisen. More and more is the application of this principle recommended, more and more numerous do the projects become that require such a co-operation, and already the mixed private and public undertaking is asserted to be not one, but *the*, future form for municipal trading enterprises.'

---

[1] W. Delius in *Report of International Conference of the International Union of Local Authorities*, Brussels, 1930, vol. ii, p. 266.

[2] Ibid., pp. 267-8.

[3] Richard Passow, *Die gemischt privaten und öffentlichen Unternehmungen*, Jena, 1912, p. iii.

The first important mixed undertaking to be created was the Rheinisch-Westfälische Elektrizitätswerke—that 'classic example'[1] 'which beginning from a works for the local area of the city of Essen, since 1905 has grown to be the most important electricity works in Germany, and this in the form of a mixed undertaking'.[2] The Rheinisch-Westfälische Elektrizitätswerke A.G. was formed in 1898 for the purpose of supplying the city of Essen with electricity, for which it had taken over a concession granted earlier in the same year to its founder, the Elektrizitäts A.G. Frankfurt. On its board of directors were the Chief Burgomaster of Essen and the industrial magnate Hugo Stinnes. A generating station was erected on Stinnes's mine 'Victoria Matthias', and the first supply was given to the city in the year 1900. In 1902 the Elektrizitäts A.G. Frankfurt sold its shares to Hugo Stinnes and August Thyssen and, under a new board of directors consisting of these two industrialists and the Chief Burgomaster of Essen, the R.W.E. entered upon a new and ambitious programme. This was nothing less than a scheme for the supply of electricity to the whole of the Rhine-Westphalian industrial area; to this was subsequently added the plan of owning and organizing in a similar unified manner the whole of the tramway and gas-supply services of this area.

The plan was at first pursued with good success. 'In rapid succession the R.W.E. was able to secure contracts for the supply of current to fresh local authorities, industrial enterprises, railway officials, &c. In many cases, small private and municipal works were bought up.'[3] But towards the end of the financial year 1905–6, which was a year of particularly great extensions, a sudden opposition to the 'Stinnesche Elektrizitätsmonopol' arose. The press, public officials, the big electrical manufacturing firms, and a number of large coal-mines, for various reasons began to express their fear and jealousy of the giant company that had so suddenly grown up in their midst. The cities of Cologne, Düsseldorf, München-Gladbach, Neuss, and Rheydt bound themselves to enter into no contracts with the R.W.E. without first giving

[1] Delius, op. cit., p. 267. [2] Ibid., loc. cit. [3] Passow, op. cit., p. 8.

warning. Bochum, Dortmund, and Hagen made a similar pact. On every hand the R.W.E. found new difficulties.

It was undoubtedly because of this combined opposition that the R.W.E. took the unexpected step of offering some of its shares to various public authorities. These offers were at first refused, but in 1908 the district of Essen bought shares to the value of 750,000 marks, the total nominal capital of the company then being 30,000,000 marks. This example was soon followed by the districts of Solingen and Dinslaken, and in 1910 by several other local authorities. According to Dr. Passow, the chief motive on the part of the public authorities in becoming shareholders 'was in every case the desire to exercise an influence over the undertaking which supplied them with current'; but 'the wish to share in the profits of the undertaking also played an important part'.[1]

The original capital of the company amounted to 2,500,000 marks. This was raised during the first two years of its existence to 4,000,000, in 1903 to 10,000,000, in 1906 to 30,000,000, and in 1910 to 38,000,000 marks. In 1910 the capital was distributed among shareholders as follows:

		Marks
City of Essen		4,725,000
City of Mülheim		1,000,000
City of Gelsenkirchen		500,000
District of Essen		787,000
District of Solingen		787,000
District of Dinslaken		650,000
District of Cologne		500,000
District of Mettmann		500,000
District of Rheinbach		500,000
District of Geldern		500,000
District of Cleve		500,000
District of Kempen		500,000
District of Mörs		500,000
District of Rees		500,000
Municipality of Old Essen		250,000
Municipality of Hermülheim		250,000
Public authorities	about	13,000,000
Private shareholders	about	25,000,000
Total nominal capital		38,000,000

---

[1] Ibid., p. 30.

That is to say, in 1910, less than 30 per cent. of the capital was in public hands. In 1926, of the total capital of 140,000,000 marks, 56,500,000 marks was publicly owned, and 83,500,000 privately.[1] The proportion of public capital, although it had increased, was still considerably short of 50 per cent. Nevertheless, as a result of the creation of certain 20-mark shares which were held by the public authorities and carried the same voting power as the 100-mark shares which the private shareholders held, the public authorities actually had between them a voting majority at the general meetings. As early as 1910 they had a majority on the board of directors, their representation then being 14 out of 24. By 1927 this proportion had changed to 68 out of 90.[2]

But although the voting and directorial majority arithmetically computed was thus assured to the public interests, in actual practice it was found that a solid private vote often prevailed against a split public vote. Dr. Passow, in 1912, stated that 'contracts with regard to disposal of shares, common exercise of voting powers, and the like, do not appear to have been concluded between the different public bodies';[3] but at some time before 1927 the public shareholders of the R.W.E. had, according to the German Union of Local Authorities, 'made arrangements with one another, which forbid the sale of municipally-owned shares to any but public bodies, under penalty of a fine'.[4] Arrangements for the unification of the public vote appear to be in contemplation.

The R.W.E. now supplies with electricity the district bounded on the north by the Dutch frontier, on the west by the French frontier, on the south by the Palatinate and the district around Frankfort-on-Main, and on the east by the Westphalian and Hanoverian borders. The total area thus served amounts to more than 16,000 square miles, and has about 9,000,000 inhabitants. The total capacity of the plant used is about 540,000 kw.[5]

The history of this interesting undertaking has been quoted at some length because its development has in several ways been typical of that of the many other mixed undertakings which have come into existence in Germany since 1908.

1. In the first place, the R.W.E. belongs to the electricity and

---

[1] Report of the German Union of Local Authorities, Conference of the International Union of Local Authorities, op. cit., p. 196.

[2] Ibid., loc. cit.

[3] Passow, op. cit., p. 32.

[4] Report of the German Union of Local Authorities, op. cit., p. 196.

[5] Ibid., pp. 194-6.

tramway industries, in which all the earliest developments of the principle of mixed management occurred.

2. In the second place, the R.W.E. was typical in being formed from existing private undertakings. In this first period, this was nearly always the order of events. In no case among the 111 undertakings in the twenty-eight cities was a mixed undertaking formed before the War from existing public undertakings, or operated from the first under mixed management. This fact is very significant in connexion with points raised in the next section.

3. The most typical thing about the R.W.E. was the motives which led to its formation. It may be taken for granted that very few industrialists would in general prefer their undertakings to be subjected to mixed management rather than have them free from public co-operation if not from public control. On occasions, it is true, a private firm may seek public collaboration for the sake of prestige,[1] or financial assistance, or 'influence',[2] or some other advantage. But in the absence of such special motives, private concerns are rather likely to shun than to court partnership with public bodies.

It might at first seem, therefore, that the formation of the R.W.E. was not at all typical inasmuch as the first movement came from the side of private industry, and was actually at first repulsed by the public authorities. Nevertheless, to assume from this that the original motive came from the private side is to be misled by appearances. Hugo Stinnes showed no signs of willingness to offer half of his 'electricity monopoly' to the public until it seemed likely that the public was preparing to appropriate the whole of it. After that, he appears merely to have acted on the principle that half a loaf is better than no bread. Whenever the first overt movement towards the creation of a mixed undertaking has come from the private side, and there exist no such special motives as the desire for public prestige or financial assistance, the motive of the private party appears always to lie in the desire to forestall impending municipalization.[1]

---

[1] 'Umgekehrt ist es auch vorgekommen, dass eine vorhandene Privatgesellschaft die finanzielle Hülfe der Gemeinden notwendig hatte. . . oder in der Verbindung mit der Gemeinde günstige Gewinnquellen und Absatzmöglichkeiten erblickte.' Delius, op. cit., p. 266.

'Es kommen auch für die privaten Beteiligten eine Reihe von Gesichtspunkten in Betracht, die ihnen vielfach den gemischt privaten und öffentlichen Betrieb ganz allgemein als erwünscht erscheinen lassen. Dahin gehört vor allem die durch die Beteiligung öffentlicher Körperschaften regelmässig ermöglichte *Erleichterung der Kapitalbeschaffung*. Die beitretenden Kommunen usw. sollen das Unternehmen dadurch fördern, dass sie ihren "billigen kommunalen Kredit" zur Verfügung stellen.' Passow, op. cit., p. 140.

[2] 'Die Erleichterung der Kapitalbeschaffung ist aber nicht der einzige Grund, der den Privaten den gemischt privaten und öffentlichen Betrieb als wünschenswert erscheinen lässt . . . Überhaupt ist in allen den zahlreichen Fällen, wo es sich um Verhandlungen mit Behörden handelt, die öffentliche Beteiligung sehr nützlich, denn von Behörden wird sehr viel mehr erreicht, wenn man betont, dass "Vertreter der öffentlichen Interessen" im Aufsichtsrat sitzen, dass der Ertrag des Unternehmens zum grossen Teil öffentlichen Körperschaften zufliesst, usw.' Ibid., pp. 141-2.

For, in the last resort, the public bodies always have the whip hand. The private parties naturally desire in general as much private management (and private profit) as they can secure. When the possible alternatives, as determined by the public body, are private management and mixed management, private industry will oppose mixed management; but when the only alternatives offered by the public body are mixed management and public management, private industry will champion the cause of mixed management, and even in some cases be the first to throw down the gage, suitably disguised, of course, as an olive branch. But their apparent enthusiasm in such cases is only the enthusiasm of those who jettison half a cargo to save the rest.

The real motives, then, for the transformation of private into mixed undertakings, were nearly always, in this initial period, those of the public authorities. In general, during this period, public authorities were very strongly opposed to the private management of their utility services. This attitude was partly a consequence of experience gathered during the early years of the history of such industries. In particular it was widely believed that private management was frequently a bar to extensions and improvements of service that would have been in the general interest, and also that it was impossible to devise a method of control which would not be either so loose as to allow the undertaking to develop in unintended ways or so strict as to prevent it from developing at all. In later years a further objection to private management was found in the fact that it allowed capitalists to secure profits that might in other circumstances have flowed into municipal exchequers. For many local authorities, private enterprise in the public utilities was unthinkable.

---

[1] 'Es ist nun schwer festzustellen, wo die Triebfeder zu dieser geplanten Umorganisation liegt, man wird aber wohl nicht weit fehlgehen, wenn man sie in denjenigen Unternehmerkreisen sucht, deren Geschäfte eben auf den Bau und Betrieb von Wasser-, Gas-, und Elektrizitätswerken zugeschnitten sind, und die sich sagen: Kann ich nicht die Konzession für das *ganze* Unternehmen erhalten, so bin ich auch mit der Hälfte zufrieden.' Pichler, op. cit., p. 81.

But public management had also proved disappointing in practice. 'After a powerful current of opinion had long demanded the municipalization of the tramways and electricity and gasworks, and after actual municipalization was very far advanced, a certain disillusionment in many cases made its appearance. Whilst attention had long been drawn almost exclusively to the advantages of public management, practice demonstrated the existence of big drawbacks.'[1]

Certain public authorities therefore found themselves on the horns of a dilemma. Their own experience had convinced them of the unsatisfactory nature of controlled private management in the public utility industries; that of some of their contemporaries had convinced them of the equally unsatisfactory nature of public management. Many such authorities welcomed the principle of mixed management as a convenient *via media* which promised escape from many of the disadvantages of the two older ways.

i. With some authorities, the principal motive was to avoid the financial risk of public enterprise.

ii. Other public authorities were influenced chiefly by their desire of avoiding the confusion of political and business considerations that was a common feature of public management, especially in the tramway industry.

iii. A third public motive for the formation of mixed undertakings was the result of technical developments in the electricity-supply and tramway industries, in which the most economic business units were beginning to overstep local government boundaries. Very frequently, public bodies which wished to take over the operation of the undertakings that supplied their areas with certain services were unable to do so, because these undertakings also supplied other areas. It is true that public authorities in such a position were free to enter into arrangements with the other local authorities concerned by which the undertaking could be managed jointly, or by one authority for the benefit of all. But such arrangements have always been difficult to make, owing to the suspicion with which local authorities are apt to regard one another's territorial ambitions—suspicion which, especially on the part of the smaller neighbours of big cities, is often by no means groundless. Mutually mistrustful local authorities have sometimes no objection to co-operating in a mixed undertaking, however, where private industrial interest may be expected to exercise control over municipal rivalries. Mixed undertakings, for the same reason, are more often able to come to friendly arrangements with outside local authorities than are purely public undertakings, whose motives are always *a priori* suspect. Even where a single authority could have operated a large-area undertaking without encountering opposition, it might hesitate to incur the very heavy financial burden involved. Such a burden might well be shared among several public and private parties, however.

---

[1] Passow, op. cit., p. 128.

iv. A final objection of many municipalities to public operation was that under it 'the anticipated large balances often failed to materialize or were reduced by wage-increases, price-reductions, and the like'.[1] It sometimes promised to be better business for the municipalities to share in the profits of mixed undertakings than to secure the whole of the much lower profits of their public undertakings.

These disadvantages of public management were not universal grievances, however, and there remained a large number of undertakings for which public management would have been preferred on balance, not only to private but also to mixed management. Many such undertakings were municipalized outright, either automatically with the expiry of concessions or else by purchase. But purchase was generally a very expensive matter, and many municipalities were forced to compromise with the private concerns that they wished to municipalize by uniting with them in a mixed undertaking.

4. Finally, the R.W.E. was typical of the early mixed undertakings in Germany in the methods adopted for its creation and operation. The private undertaking was brought under mixed management by the purchase of some of its shares by municipalities. This was the usual method employed for the creation of a mixed undertaking. The amount of capital held by the municipalities and other public bodies was small at first, but later increased. This again was usual, although the actual amount of capital in public hands has been almost the whole capital in some mixed undertakings and little more than a merely nominal amount

---

[1] Passow, op. cit., p. 128.

in others.[1] In order to prevent the outvoting of the public parties where the capital they held amounted to less than 50 per cent. of the total capital of the undertaking, various safeguards were commonly adopted. Of these, the two adopted in the R.W.E.—disproportionate representation on the board of directors and the issue of low-priced shares—were among the most usual. Lastly, where several public bodies belonged to one undertaking and had a combined voting-majority, it was usual for some such arrangements to be entered into as those by which the solidarity of the public vote in the R.W.E. is likely to be secured.

The principle of mixed management, once its practicability had been demonstrated by the success of the R.W.E., was eagerly introduced into other important public utility undertakings. Some authorities saw in it '*the* future form' of management; others were more cautious in their judgement. But even Dr. Passow in his admirably objective study[2] could not entirely disguise the fact that he hoped for great things from the new development. Indeed, the mere publication of his book was significant.

By 1914 there were ninety-one mixed undertakings in seventy-five large German cities.[3]

II. *The Period of Temporary Extension, 1914–18*: The World

---

[1] In 1920 the German Union of Local Authorities sent a questionnaire on the subject of mixed undertakings to 159 of its members. From their replies the following table was constructed:

TABLE V

Mixed Undertakings in Germany, 1920

Population of town	*No. of towns in group*	*No. of mixed undertakings* in which the municipality held *50 per cent. or more of the capital*	*No. of mixed undertakings* in which the municipality held *less than 50 per cent. of the capital*	*No. of mixed undertakings* *for which no information was returned*
Up to 30,000 .	36	10	6	16
30,000–50,000 .	51	30	19	39
50,000–100,000 .	33	45	9	26
Over 100,000. .	39	91	34	52
All groups . .	159	176	68	133

—Paul Mitzlaff and Erwin Stein: *Die Zukunftsaufgaben der deutschen Städte*, Berlin, 1925, p. 943.

[2] Op. cit.

[3] Delius, op. cit., p. 267.

War not unnaturally hindered the ordinary development of the mixed undertaking as of some other things. But it was also responsible for the application of the principle to completely new types of concern. The forerunner of this new development was the city of Strasburg, which soon after the outbreak of war found its food-supplies threatened. Some special organization of the food-dealers was necessary, and the kind of organization chosen was the mixed undertaking. A special company, the Gesellschaft für Volksernährung m.b.H., was formed, with a capital of 21,000 marks, of which the city held 10,000 marks, private food-supply firms 10,000 marks, and the district of Lower Alsace 1,000 marks. 'The limited company form of mixed undertaking was thus used here for the first time for the purpose of safeguarding the food-supplies of urban populations.'

During the first part of 1915, many food-supply firms in various parts of the country applied to the government to assist them to reduce the greatly enhanced risks of their business. The method most commonly adopted for securing this end was that used in Strasburg. After a time, however, these organizations tended to lose their mixed character and to become mere food-control bodies.

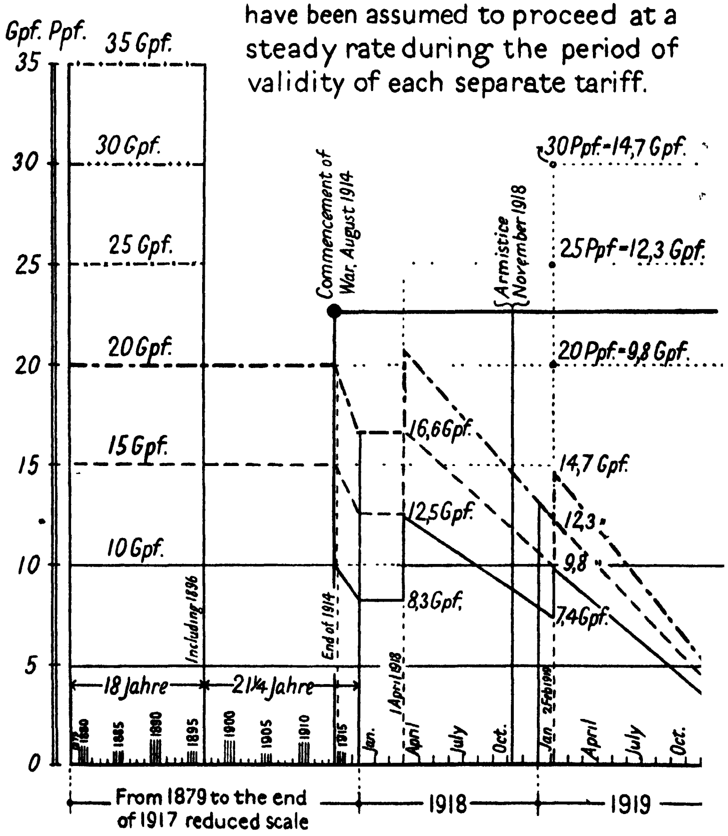
The chief characteristics of the development of the mixed undertaking during this period are: (i) the new field—the food-supply industries; (ii) the new motive—a desire to prevent the complete breakdown of the system; and (iii) the complete fruitlessness of the experiment, which quickly came to an end and did not add materially to knowledge concerning the scope of the mixed principle. That mixed management could ever be required for such industries during peace-time is at least highly improbable;[1] and the war-time experiments shed no light whatever upon the problems of mixed management of the public utilities.

---

[1] Compare the opinion of Sir William Beveridge on similar questions in England: 'The chief merits of control as they appear in the foregoing pages are inseparably connected with a prolonged and serious shortage of supplies. It is hard to see how in Britain such a condition can occur again, through any cause other than a new general war.' *British Food Control*, Humphrey Milford, London, 1928, p. 343. 'I can only record here, as a result of Ministry of Food experience, a personal doubt of any gain either to consumer or producer from public regulation of food-supply in peace, that would repay the cost of the vast organization involved, or justify diversion to it of any of the limited store of political energy and ability needed for more urgent problems, or outweigh the risk of bribery by subsidies.' Ibid., p. 344.

DIAGRAM VI. FLUCTUATION OF STETTIN TRAMWAY FARES IN GOLD MARK VALUES

NOTE: For purposes of simplification variations in the value of the currency have been assumed to proceed at a steady rate during the period of validity of each separate tariff.



III. *The Period of Socialism, 1918–21*: The few years immediately succeeding the signing of the Armistice saw a new enthusiasm for municipal enterprise, mainly resultant from the socialistic trend of the politics of the day. Special legal powers were sought to enable local government authorities not merely to undertake many kinds of business that had previously been left to private enterprise, but to enable them to annihilate all private competition in these businesses. Among the industries for which these powers were sought were those of food- and fuel-supply.

One result of this movement was a change of attitude towards the mixed undertaking, which was regarded by some socializers as an unworthy compromise with a clear universal principle and by others as a convenient stepping-stone to higher things.

A return to more normal economic conditions demonstrated the unsubstantial nature of many of the schemes of the socializing party. But the final blow to the idea of widely extending municipal trading was struck by the currency troubles of the period 1922–3.

IV. *The Period of Currency Inflation, 1922–3*: The public utilities were particularly embarrassed by the rapid depreciation of currency which was at its worst in 1922 and 1923. Their first difficulties were associated with their tariffs of charges. Despite frequent revisions—the Cologne tramways, for instance, published no fewer than twenty-five revised tariffs between June 1st and November 29th, 1923—it was found impossible to keep prices, especially tramway fares, at anything like a steady 'real' level. The difficulties of this period are illustrated by Diagram VI, which shows the nominal (Paper-mark) and real (Gold-mark) levels of tramway fares in Stettin for the period 1918–23.

And this was not the only financial difficulty that the municipalities had to face. 'For a long time there was scarcely any public credit for municipal corporations. The companies ruled the market with their newly-issued shares, which were heavily speculated in. The Reichsbank discounted the bills of all companies without restriction, whilst municipal bills were for a long time refused as financial paper. The cities which had to procure coal from England could not obtain bills, and this greatly increased the difficulties of the coal-supply, and favoured those works that were in direct connexion with mines. All these circumstances led to the re-opening of the question of the organization of municipal enterprises. Away with municipal representation, away with municipal administration!, was the watchword.'[1]

In the view of some authorities, the public bodies were unnecessarily precipitate in thus seeking the aid of private capital and private business methods. The Superintendent of the Mannheim Public Works has, for instance, described the events of this period in the following terms: 'It is admittedly true that, owing to the big difficulties occasioned by the inflation and the period which followed it, many municipalities, particularly the smaller ones, lost their heads and were quite ready to take refuge unconditionally in the bosom of private enterprise, which of course received them with open arms.'[2] Other authorities argue that many municipalities had no alternatives but to do this or become bankrupt. The movement seems to have been most pronounced among the smaller cities.

V. *The Period of 'Improved Public Management', 1924–30*: Since the stabilization of the mark, the principle of mixed management has experienced another decline in popularity in Germany. The reasons for this are twofold. In the first place, when their finances were once more placed upon a firm basis the municipalities no longer needed to 'take refuge in the bosom of private enterprise'. And in the second place, their position as municipal enterprises was considerably strengthened by the introduction of various improved types of public administration which, while often giving many of the advantages of the mixed undertaking, preserved all the advantages of complete public control.

These forms have received in Germany the names 'improved public management'[3] and 'public management in company form'. By the first is meant public management with a larger degree of independence from the general administrative system than had been usual. Perhaps the most important feature of 'improved public management' is the financial independence secured to the enterprise by the substitution of ordinary for 'budgetary' methods of accounting. The second term is self-explanatory. A public undertaking in company form is a company of which the sole shareholder is a public body.

---

[1] Chief Burgomaster Lueken at the tenth annual meeting of the Preussischer Städtetag, May 27th, 1925. Quoted by German Union of Local Authorities, Conference of the International Union of Local Authorities, op. cit., p. 182.

[2] Herr Pichler, Superintendent of the Mannheim Public Works, *Die Regiebetriebe der Gemeinden*, p. 81.

[3] *Verbesserte Regiebetriebe.*

A typical public undertaking in company form is the Werke der Stadt Halle A.G., which was founded in 1929. The undertaking consists of mines, electricity works, a gasworks, a waterworks, and a tramway system. Until 1922 these undertakings were all independent of each other, although municipally owned. On April 1st of that year a central financial administration for the gas, water, and electricity undertakings was set up, and on January 1st, 1924, the business management was centralized under one General Director. On November 1st, 1924, the mines, and on March 1st, 1925, the trams were also brought into the centralized system. On April 1st, 1926, the existing public-finance methods of bookkeeping were superseded by the ordinary system of double-entry. On October 1st, 1927, all the undertakings were completely unified with the name Werke der Stadt Halle, and on June 16th, 1929, the enterprise was transformed into a company with a capital of 12 million marks, of which the city was the sole holder. For the alienation or mortgage of shares, the permission of the company, of the city *Magistrat*, and of two-thirds of the municipal council, is necessary. The Board of Directors consists of five members under the chairmanship of the General Director, and the Board of Supervision[1] of three paid and two unpaid members of the *Magistrat*, eight members of the municipal council, and two honorary expert members, under the chairmanship of the Chief Burgomaster. Five per cent. per annum is the prescribed rate of depreciation, and at least a further 5 per cent. must be devoted to the creation of a reserve. The general meeting disposes of the rest of the trading balance as it sees fit, subject to the proviso that 20 per cent. of it shall be received by the city for the relief of local taxation.

The Werke der Stadt Halle A.G. is a fair representative of the many 'municipal companies' that have recently been established in Germany. Its most typical features are: (i) the motive for its establishment—chiefly the desire of the municipality to secure business-like administration without losing direct control; (ii) the sphere of its establishment—principally in the public utility industries; (iii) the method of its establishment—unification of public enterprises finally followed by a little more than nominal change of form;[2] (iv) the safeguards employed—special rules as to share-holding and directorship on the one hand, coupled with complete independence in the detailed conduct of the undertaking on the other.

---

[1] *Aufsichtsrat.*

[2] Municipal companies have usually, but not always, been formed from municipal undertakings. Exceptions among the larger cities are to be found in Berlin, Königsberg, and Altona.

'Improved public management', which formed a stage in the transformation of the Stettin undertakings and has been adopted as a final solution most notably in Dresden and Leipzig, aims to secure the same results as the municipal company without the formality of forming a company. At its best, it need not be essentially different from the municipal company; at its worst, it may be merely bureaucracy worse bureaucratized. In many cases it seems to give complete satisfaction. Its chief weakness is that it lacks most of the safeguards of the municipal company and that its effectiveness therefore depends largely on the personal influence of burgomasters and city councils.

For these new forms in preference to 'ordinary' public management there appears to be everything to be said.[1] Whether they are also superior to private forms of management for public utilities is another question, which must be answered one way or the other according to local conditions and aims. In general, the discovery of the new forms appears to have left the argument of public versus private management in much the same position that it occupied thirty years ago, except that it has removed some of the objections to public management. But it has certainly done away with the chief *raison d'être* of the mixed undertaking. The growth and extension of the new forms should probably be expected.

---

[1] Cp. the following interesting statements of Mr. J. M. Keynes: 'It is true that many big undertakings, particularly Public Utility enterprises and other business requiring a large fixed capital, still need to be semi-socialised. But we must keep our minds flexible regarding the forms of this semi-socialism. We must take full advantage of the natural tendencies of the day, and we must probably prefer semi-autonomous corporations to organs of the Central Government for which Ministers of State are directly responsible' (*The End of Laissez-Faire*, London, 1926, pp. 44–5); and of the Liberal Industrial Inquiry of 1928: 'We are in favour of municipal trading in the sense of local public ownership of local public utilities. But we are doubtful whether the right form of organisation and the right geographical unit have yet been attained. As regards organisation, there are often objections to direct administration by Committees of Local Authorities. As in the case of State enterprises, the right model seems to us to be one which borrows some of the machinery of large-scale private enterprise. Generally speaking, an *ad hoc* body should be set up, the executive and administrative Board of which would correspond to the Board of Directors of private concerns . . ., the Local Authorities themselves corresponding to the shareholders' (*Britain's Industrial Future*, London, Benn, 1928, pp. 76-7). 'We think that a Board of this kind, appointed by and ultimately responsible to some public authority, national or local—but only in the sense in which a company is responsible to its shareholders—is a better model to follow than that of direct public trading, whether national or local' (ibid., p. 77).

There are no complete sources of information as to the number of municipal companies in the public utility industries as a whole. The number of municipal utility undertakings in company form among the 111 public utilities in the largest German cities at the beginning of 1930 was eighteen, divided among industries as follows:

TABLE VI

Public Undertakings in Company Form, 1930

Industry	*Number of municipal companies*
Water-supply . .	5
Gas-supply . .	5
Electricity-supply .	5
Tramway . .	3
All . . .	18

The total number of such companies was less than eighteen, however, since in several cities various undertakings are operated by the same municipal company. This is notably the case with the Königsberger Werke und Strassenbahn G.m.b.H. (electricity-supply, gas-supply, water-supply, tramways), the Werke der Stadt Halle A.G. (ditto), the Öffentliche Werkbetriebe der Stadt Stettin G.m.b.H. (water, gas, and tramway).

Of the above eighteen undertakings, fifteen were under public management before their transformation into companies, one (the Berlin tramways) passed through successive stages of private management, municipal company management, direct municipal management, and municipal company management again, one (the Königsberg electricity undertaking) was under private management before being turned into a municipal company, and one (the Altona electricity undertaking) passed through successive periods of private and mixed management before being municipalized as a company.

Summary of the Period of Experiment with Compromise Forms of Management: The period of attempts at compromise thus appears to have led to results whose significance is negative rather than positive. 'The history of the Mixed Undertaking in Germany exhibits a constant rise and fall.'[1] It 'thus exhibits no uniform tendency and merely demonstrates afresh that the development of the Mixed Undertaking is completely dependent on *Weltanschauungsfragen* and the general economic position'.[2]

Of the mixed undertakings established in the twenty-eight cities, practically all have continued in existence till the present day. Their history is given in the following tables and diagrams, which may well confirm the opinion independently arrived at that the day of the mixed undertaking, except in special circumstances,[3] is over.

TABLE VII

Number of Mixed Undertakings in the twenty-eight largest German Cities, at the beginning of 1930

Industry	*Undertakings*
Water-supply . .	1
Gas-supply . .	2
Electricity-supply .	6
Tramway . .	9*
All . . .	18

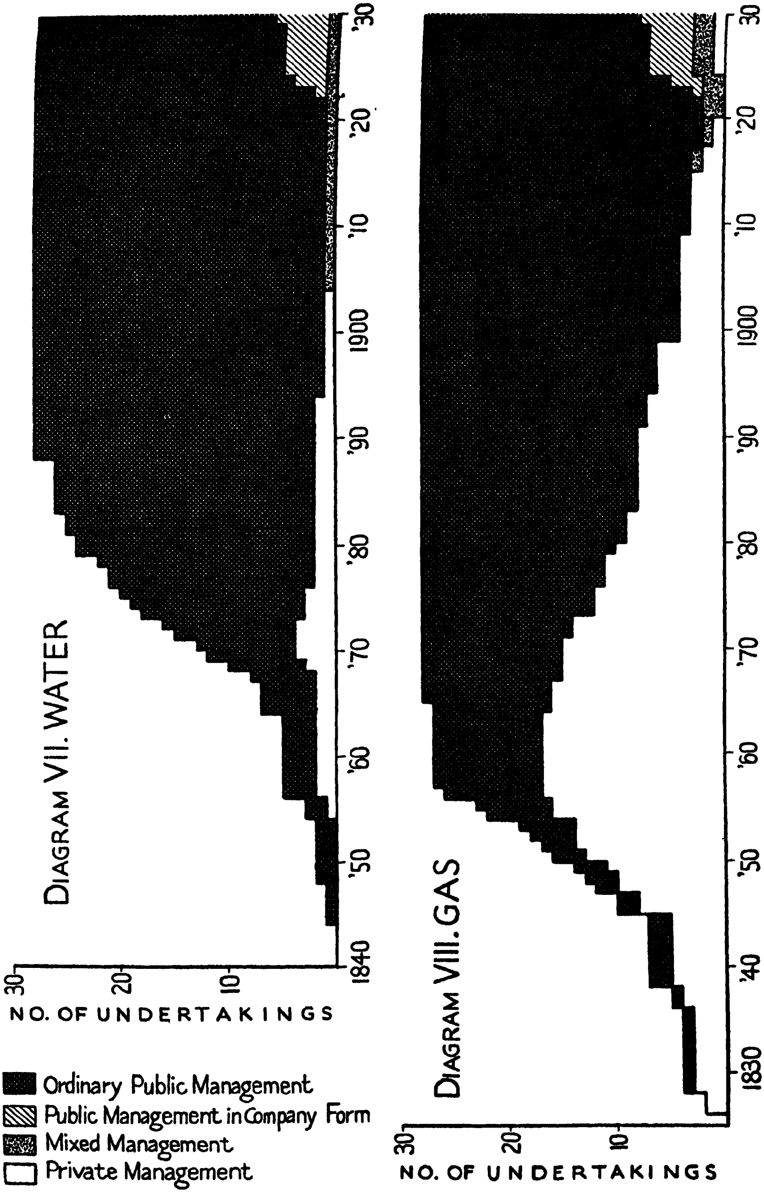
* One of these in two cities (Hamburg and Altona).

Our knowledge of the extent to which the principle of mixed management is applied to industry as a whole and in the country as a whole is very scanty. The German Union of Municipal Statisticians gives a certain amount of information relating to cities with a population of not less than 50,000. From this source we learn that there were, in 1928, 11 electricity undertakings under mixed management of 99 electricity undertakings in such cities altogether; and 28 mixed tramway undertakings of 97 undertakings altogether.[4] The only other fairly recent source of information on this matter is provided by the published results of the questionnaire issued by the German Union of Local Authorities in 1920. This again is by no means a complete source of information since it does not deal with all German cities. Furthermore, some of the cities which were included in the inquiry returned incomplete answers. Nevertheless, we have reason to be grateful even for such

---

[1] Delius, op. cit., p. 268.
[2] Loc. cit.
[3] See Chap. II, p. 12.
[4] *Statistisches Jahrbuch deutscher Städte*, 1930.

HISTORY OF THE MANAGEMENT OF PUBLIC UTILITY UNDERTAKINGS



HISTORY OF THE MANAGEMENT OF PUBLIC UTILITY UNDERTAKINGS

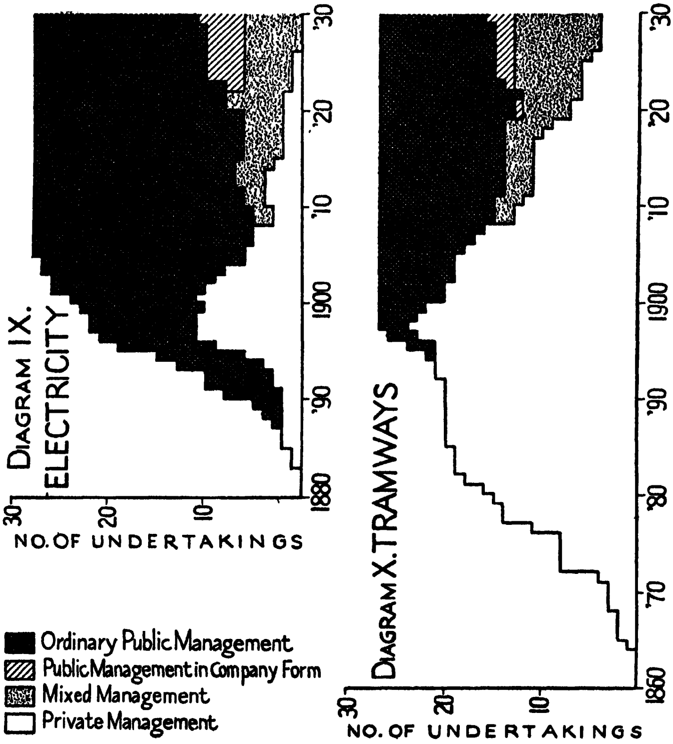


TABLE VIII

History of the Mixed Undertaking in the twenty-eight largest German Cities

		MIXED UNDERTAKING		
Industry	*City*	*Antecedent History*	*Period of Mixed Management*	*Subsequent History*
Water .	Gelsenkirchen	Private 1868–1904	1904–	—
Gas . .	Frankfort	Private 1828–1915	1915–	—
	Dortmund	Private 1857–1920	1920–	—
Electricity .	Hamburg	Private 1893–1914	1914–	—
	Essen	Private 1900–8	1908–	
	Gelsenkirchen	Private 1905–8	1908–	—
	Stettin	Private 1885–1926	1926–	—
	Altona	Private 1892–1901 Municipal 1901–12	1912–22	Municipal Co. 1922–
	Barmen	Municipal 1888–1920	1920–	—
	Elberfeld	Municipal 1887–1920	1920–	—
Tramway .	Hamburg	Private 1864–1918	1918–	—
	Essen	Private 1892–1908	1908–	—
	Düsseldorf	Private 1876–99 Municipal 1899–1922	1922–	—
	Stuttgart	Private 1868–1917	1917–	—
	Gelsenkirchen	Private 1897–1910	1910–	—
	Duisburg	Private 1881–1925	1925–	—
	Stettin	Private 1879–1926	1926–	—
	Bochum	Private 1896–1908	1908–	—
	Elberfeld	Private 1871–1921	1921–	—

a partial view of the field as this provides, for it is the only attempt to deal with the question as it affects Germany as a whole. The chief figures resulting from this inquiry are quoted in Mitzlaff and Stein.[1] They may be summarized as follows:

TABLE IX

Public and Mixed Undertakings in Germany, 1920

	PUBLIC OR MIXED UNDERTAKINGS			*These undertakings were*			
				Public		*Mixed*	
Type of Undertaking	*Towns*	*Percentage of reporting Towns*	*Undertakings*	*No.*	*%*	*No.*	*%*
Tramways . .	*82*	*51·6*	*106*	*67*	*63·2*	*39*	*36·8*
Transport . .	—	—	477	405	85·1	72	14·9
Water-supply .	*151*	*95·0*	*159*	*151*	*95·0*	*8*	*5·0*
Gas-supply .	*146*	*91·8*	*153*	*144*	*94·1*	*9*	*5·9*
Electricity-supply.	*136*	*85·5*	*152*	*118*	*77·6*	*34*	*22·4*
Water, Gas, Elec.	—	—	464	413	89·0	51	11·0
Refuse Disposal .	—	—	554	543	98·2	11	1·8
Food supply .	—	—	775	734	94·7	41	5·3
Hygienic . .	—	—	991	975	98·4	16	1·6
Domestic Supplies	—	—	770	637	82·8	133	17·2
Financial, &c. .	—	—	601	548	91·1	53	8·9
All. . .	159	100	4,632	4,255	91·9	377	8·1

TABLE X

Analysis of Table IX

Population of Town	*No. of Towns in Group*	NO. OF UNDERTAKINGS			
		Public		*Mixed*	
		Absolute	*Per Town*	*Absolute*	*Per Town*
Up to 30,000 .	36	541	15·0	32	0·9
30,000–50,000 .	51	1,071	21·0	88	1·7
50,000–100,000 .	33	857	26·0	80	2·4
100,000 and over	39	1,786	45·8	177	4·5
All groups .	159	4,255	26·8	377	2·4

---

[1] Op. cit., pp. 940 ff.

GENERAL SUMMARY AND CONCLUSIONS

In general, then, German public utilities began as private undertakings and have been more and more municipalized. During recent years, experiments in mixed management have apparently had the net result not of weakening but of strengthening the case for public operation, by introducing a much improved technique of public management.

As will be seen from Diagram I, the degree of municipalization has always been highest in the water-supply and lowest in the tramway industries; but the same sort of progression is observable throughout the history of each of the local utilities. It is regrettable that no co-ordinated information is available concerning this history, not merely as regards a few large cities, but for the industries as a whole.[1] Diagrams II–V, which are based on information relating to the twenty-eight largest German cities only, will serve to give some idea of the general development, however, if the fact be borne in mind that changes have generally occurred in these cities several years before their occurrence in the smaller cities and villages.

Diagrams VII–X illustrate the history of the management of the public utilities of the twenty-eight cities considered as a whole; and diagrams XI–XIV the development of the management of the individual utilities.

Even as regards the present position of control in Germany, the available information is scrappy. For the twenty-eight cities

---

[1] The following figures are quoted in *Öffentliche oder private Gasversorgung?*, Verband der Gemeinde- und Staatsarbeiter, Berlin S.O. 36, 1928. They show a lag of about 10-20 years behind the figures for the 28 largest cities.

TABLE XI

History of Ownership of all German Gasworks

Year	% *public*	% *private*
About 1860	25	75
1877	46	54
1883	48	52
1885	51	49
1896	58	42
1899	56	44
1908	67	33

DIAGRAM XI. DEVELOPMENT OF THE MANAGEMENT OF WATER UNDERTAKINGS IN 28 GERMAN CITIES

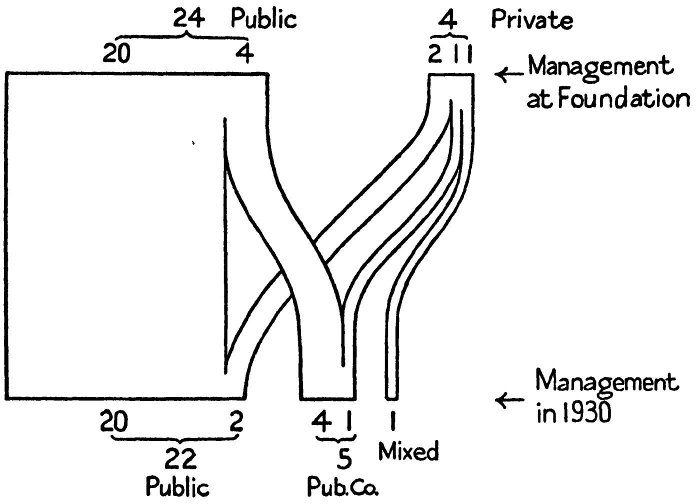


DIAGRAM XII. DEVELOPMENT OF THE MANAGEMENT OF GAS UNDERTAKINGS IN 28 GERMAN CITIES

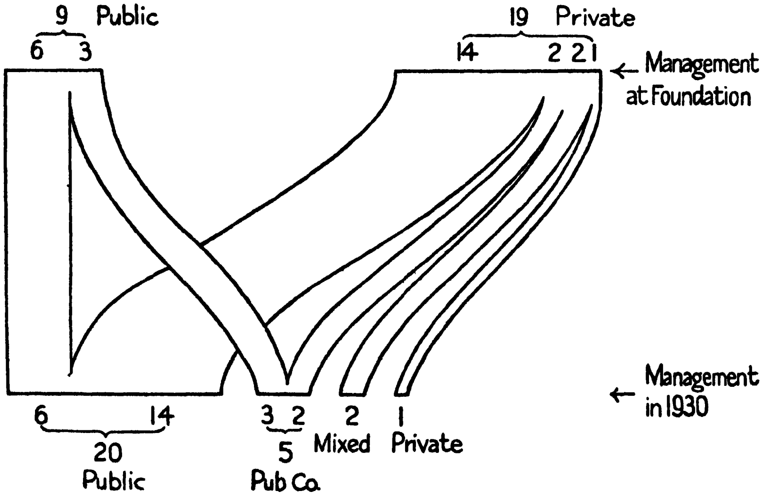


DIAGRAM XIII. DEVELOPMENT OF THE MANAGEMENT OF ELECTRICITY UNDERTAKINGS IN 28 GERMAN CITIES

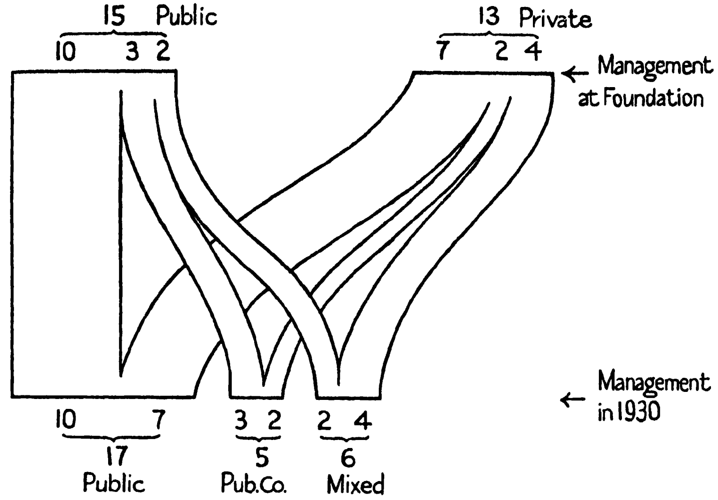
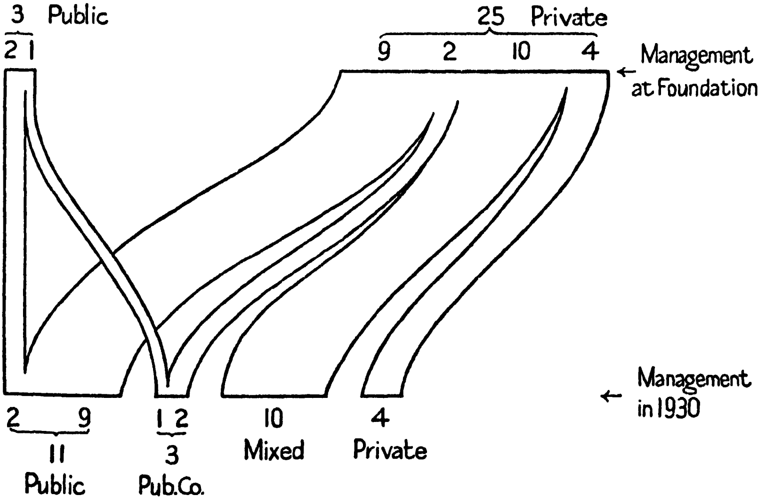


DIAGRAM XIV. DEVELOPMENT OF THE MANAGEMENT OF TRAMWAY UNDERTAKINGS IN 28 GERMAN CITIES



already referred to complete details have been given. These may be summarized as follows:

TABLE XII

Management of Public-Utility Undertakings in Twenty-eight German Cities on January 1st, 1930

	TYPE OF MANAGEMENT									
	Private		*Mixed*		*Public Co.*		*Public*		*All*	
Industry	*No.*	%	*No.*	%	*No.*	%	*No.*	%	*No.*	%
Water-supply .	0	0	1	4	5	18	22	78	28	100
Gas-supply .	1	4	2	8	5	18	20	70	28	100
Elec.-supply .	0	0	6	21	5	18	17	61	28	100
Tramway .	4	14	9	35	3	11	11	40	27	100
All . .	5	5	18	16	18	16	70	63	111	100

Fairly complete information respecting undertakings in Prussia was given in the report of the German Union of Local Authorities presented at the International Conference at Antwerp in 1930.[1] According to this report, of 1,708,101 undertakings in all branches of industry, 1,695,278 were private, 12,349 public, and 474 mixed. These undertakings belonged to public utility and other industries as follows:

TABLE XIII

Public Utilities in Prussia[1]

	TYPE OF MANAGEMENT			
Industry	*Private*	*Mixed*	*Public*	*All*
Water-, Gas-, and Electricity-supply . .	4,166	79	1,699	5,944
Transport .	38,651	139	469	39,259
Other . .	1,652,461	256	10,181	1,662,898
All . .	1,695,278	474	12,349	1,708,101

Certain defects of the method of reckoning by undertakings (according to which one—national—railway ranks as equivalent to one—village—waterworks) may be corrected by consideration of a second table, from the same source, in which the number of employees in undertakings is divided as in the above table.

---

[1] Op. cit., pp. 188-9.

TABLE XIV

Employees of Public Utilities in Prussia[1]

Industry	TYPE OF MANAGEMENT *Private*	*Mixed*	*Public*	*All*
Water-, Gas-, and Electricity-supply . . .	11,850	19,928	77,226	109,004
Transport . . .	126,943	26,506	1,181,121	1,334,570
Other . . .	9,465,534	72,338	343,208	9,881,080
All . . .	9,604,327	118,772	1,601,555	11,324,654

No such figures are available for the whole Reich. Certain different authorities give figures for parts of the field, however, which may, with reservations, be taken as representative of the whole.

Thus, according to the report referred to above, 95 per cent. of German waterworks were in public hands in 1927, and the sole important mixed undertaking was the waterworks in Gelsenkirchen. According to the *Verein von Gas- und Wasserfachmännern* the management of the gas industry in the whole of Germany in 1926 was divided as follows:

TABLE XV

Management of Gas Industry in 1926

Management in 1926	UNDERTAKINGS		ANNUAL OUTPUT	
	No.	%	*Mn. cub. m.*	%
Private .	148	12·3	137	3·8
Mixed .	67	5·6	423	11·7
Public .	986	82·1	3,057	84·5
Altogether	1,201	100	3,617	100

According to the *Vereinigung der Elektrizitätswerke* the management of the principal undertakings in the German electricity industry was divided as follows in 1928:

---

[1] Op. cit., pp. 188–9.

TABLE XVI

Management of Electricity Industry in 1928

Management in 1928	UNDERTAKINGS		ANNUAL OUTPUT	
	No.	%	*Mn. kw.*	%
Private	167	27·3	2,110	14·6
Mixed	103	16·9	4,170	28·8
Public	341	55·8	8,200	56·6
Altogether	611	100	14,480	100

The available tramway statistics are the least satisfactory of all. The best survey available is that of the Union of Municipal Statisticians, according to which there were in 1928 ninety-seven tramway undertakings in the eighty-nine cities of their report,[1] the management of which was as follows:

TABLE XVII

Management of Tramway Industry in 1928

Management in 1928	UNDERTAKINGS	
	No.	%
Private	9	9
Mixed	28	29
Public:	60	62
In company form	*12*	*12*
Ordinary	*48*	*50*
Altogether	97	100

These figures may be combined into one table as follows, somewhat illegitimately it must be admitted, seeing that their sources are so different and their fields of such varying extent. But, so long as its limitations are borne carefully in mind, such a table will probably prove sufficiently useful to justify its compilation and even to permit guarded comparisons with Tables IX, XIII, and XIV—which will lead to some not uninteresting results.

---

[1] i.e. all the cities in Germany with over 50,000 inhabitants except Erfurt, Coblenz, and Wesermünde. *Statistisches Jb. deutscher Städte*, 1930, § x.

TABLE XVIII

Management of Utilities in Germany

Industry	*Water*	*Gas*	*Electricity*	*Tramway*	*All*
Area	*Germany*	*Germany*	*Germany*	89 *cities*	*
Date	1927	1926	1928	1928	*
	%	%	%	%	%
Private Management	4†	12	27	9	13
Mixed Management	1†	6	17	29	13
Public Management	95	82	56	62	74

* See p. 58.
† Estimated.

Such statistics as these point no very definite moral. They show that public management of public utilities is on the whole preferred to private or mixed management in Germany to-day. From their historical background we may conclude that this preference will assert itself more and more widely, working down from the larger cities to the villages, only if we are prepared to assume that history never marches back over its own tracks.

FURTHER READING ON CHAPTER III

The best sources of information concerning the history of German local utilities are the memoranda on their own undertakings issued by most municipal authorities. But these memoranda, not being published through the usual channels, are sometimes not easy to obtain and in any case constitute a mass of material that is rather difficult to deal with. There is a real need for a good history of German public utilities.

PASSOW, R. *Die gemischt privaten und öffentlichen Unternehmungen.* (See note on Chap. II.)

UNION INTERNATIONALE DES VILLES ET POUVOIRS LOCAUX: *Conférences Internationales: II, Les Entreprises économiques à caractère mixte.* Rue de la Régence, 3 bis, Brussels, 1930, pp. 295.

Official representatives from Belgium, Czecho-Slovakia, Finland, France, Germany, Great Britain, Greece, Holland, Hungary, Italy, Poland, Rumania, and Switzerland read papers at this conference, some of them of the greatest importance for the student of mixed undertakings. Worthy of special mention are the reports of the German Union of Local Authorities (pp. 176-209) and the Union of Swiss Municipalities (pp. 100-36), and the Summary by Dr. W. Delius (pp. 262-82). A French translation of all the papers is given. I am indebted to the Director of the International Union of Local Authorities for his courteous permission to make use of certain material contained in the above papers, as well as in my own paper on some theoretical aspects of the subject (pp. 76-99).

CHAPTER IV

WATER-SUPPLY: CHARACTERISTICS

ADOPTING a usual if somewhat unscientific terminology, we may conveniently consider first the economic and then the social characteristics of the water-supply industry.

I. ECONOMIC CHARACTERISTICS

(a) *Nature of Costs.*

The regulation of public utilities has been partly explained by Professor J. M. Clark as follows:

> The machines which run on rails or transmit through lines of pipes or wires are set apart for special regulation, because here the 'natural' regulation of competition clearly fails to work its advertised results.[1]

Probably the most widely advertised of the results of free competition is the tendency towards uniformity among the prices charged for identical commodities throughout the market in which the competition occurs. Closely associated with this is the tendency for the prices of the commodities to approximate to their costs of production.

The conclusion that competitive prices will tend to equal costs is based on the assumption that nobody will continue to sell commodities at less than their cost to him, or be able for any considerable period to obtain more than this. The argument has long been understood to involve certain peculiarities of definition. Cost must, of course, be understood to include not only the payments which the entrepreneur has to make but also the minimum profit which will induce him to continue in business. Given such a definition, the processes which are supposed to bring about the approximation of prices to costs are easy to trace. If the prices charged by an entrepreneur are higher than is necessary to cover costs, he will be securing a more than 'normal' return for his services. This state of affairs will encourage other entrepreneurs to enter the market; it will also probably encourage the first entrepreneur to offer a greater supply. In any case there is a likelihood that the total supply of goods and services offered in the market will increase. Now it is usual for an increase in the supply of any commodity, so long as the demand for it remains unchanged, to lead to a fall in its price. This tendency for abnormally high returns to entrepreneurs to cause a fall in prices and therefore a fall in the entrepreneurs' returns may be expected to continue until these returns become normal, i.e. until prices are equal to costs.

---

[1] *The Social Control of Business*, 1926, p. 57.

If, on the other hand, prices are for any reason lower than costs, it is probable that offers will decrease and that prices will rise until they are equal to costs. This tendency to equality of prices and costs will, of course, exist in any market, whatever the number of undertakings originally composing it.

This argument—like all truly scientific arguments—is necessarily based on assumptions which correspond imperfectly with the observed facts of real life. Some of these gaps between theory and fact are hidden by the supposition that the total supply offered in a market can be increased or decreased at the will of the entrepreneurs in the market and the would-be entrepreneurs outside the market, or by the supposition, which comes to very much the same thing, that there is nothing to hinder new recruits from joining the market at any moment or old members from withdrawing. But these difficulties may be avoided if not overcome by a suitable definition of the word 'competition', and a sufficiently logical although regrettably unreal case established for the proposition that the revenue of competitive undertakings will approximate to their costs.

But this proposition, the proof of which is constructed in terms of total sales, total revenue, and total costs, cannot without further examination legitimately be predicated of individual prices. Its primary assumption is that the actions of sellers are dictated by the comparisons which they make between cost prices and selling prices. Now even where totals of prices are concerned, this is a highly idealized version of what usually happens; but it is a totally imaginary version of the genesis of individual prices. For under the conditions that are usual nowadays, individual units of commodities seldom have any peculiar costs at all. The modern entrepreneur buys or produces in batches and sells in units; or, if this is an undue simplification of a very complicated process, buys in bundles of one sort and sells in bundles of another sort. The consequence is that he can no more make a direct comparison between the price of a given sales-unit of a commodity and its cost than a farmer can make a direct comparison between the weight of an egg and the amount of poultry-food that has gone to the making of it. All that the farmer can do by way of direct comparison is to balance the total output of eggs against the total consumption of food in a given run. Even an experimentally-minded graduate of an agricultural college could make no closer comparison than that between the total food consumption and total egg production of a single hen throughout her whole life. Any attempt to take a narrower basis for a direct comparison would lead to obvious misreckonings. So it is with the ordinary dealer in most modern markets. The only direct balancing of his costs and receipts that he can make must relate to totals.

This does not mean that the basis of his calculations need always be so broad as to include all his dealings. For some calculations nothing less than this will suffice. A singer who spends five hundred pounds on having his voice trained cannot properly balance this amount against anything but the income derived from all his subsequent performances. The artist's fee for the famous 'sinking-feeling' poster cannot properly be charged against anything less than the total number of bottles of Bovril that have been sold since the poster first appeared. The general costs of promoting a company cannot properly be debited to anything less than all the business the company may transact during its whole lifetime.

Costs of this kind may be called the *overhead* costs of a whole undertaking. But the most typical kinds of cost incurred in ordinary undertakings are overhead, not for the whole undertaking, but for larger or smaller sections of its business. Thus the cost of the Lyons's Swiss Roll advertisements are overhead costs of all their Swiss Roll business, but not of their catering business as a whole.[1] The cost of firing a baker's oven is an overhead cost for one batch of bread only. The cost of the line connecting a telephone subscriber with the exchange is an overhead cost of all the calls he makes and receives but not of the telephone undertaking as a whole.

As the collection of sales-units for which a given overhead cost is incurred gets smaller and smaller, the condition that would justify a cost theory of individual prices is more nearly approached.[2]

---

[1] If we ignore (i) the probability that these advertisements indirectly encourage the sale of tea and other Lyons specialities and (ii) the possibility that the custom attracted by the advertisements can be separated from that which is independent of them.

[2] I do not mean to imply that a cost theory of prices in general could ever be justified. But this is a much larger question.

Costs which are incurred on account of single sales-units are usually called prime costs, and if all costs were prime a thorough-going cost theory of individual competitive prices would be justifiable. But very few costs of ordinary modern concerns are prime in this sense. Nearly all costs nowadays are overhead costs; that is to say, they are incurred on account of a batch of commodities as a whole and not specially on account of any particular units in the batch. And overhead costs can never form a basis for direct comparisons with the prices of any smaller group of commodities than that for which they are incurred.

The term 'overhead cost' is often used in a much looser sense than this. A very common and misleading practice is to add together all the costs which are overhead for any considerable group of units of product of an undertaking and to refer to the aggregate as *the* overhead costs of the whole undertaking. If overhead costs are defined in this way it is, of course, possible to allocate some of them on an economic basis among the various groups of units on whose account they are incurred. If for example the costs of goods-wagons and of passenger-coaches are counted together as part of 'the overhead costs' of a railway, it will certainly be possible to distribute part of these overhead costs between passenger- and goods-traffic. But overhead costs defined as in the text above cannot be 'imputed' to any particular units composing the group for which they are overhead. It is quite meaningless to say that costs are overhead unless it is expressly stated for what units of product they are overhead. Under modern conditions practically all the costs of any undertaking will be overhead for some commodity-units, and hardly any items of cost will be truly overhead for all units.

For example, the term 'overhead charges' appears to be used sometimes in the strict and sometimes in the loose sense in the following passage 'by a railway accounts expert':

> In order to fix charges calculated to produce a pre-determined net revenue, it is clearly essential to be able to estimate working costs with accuracy. In so far as railways are concerned, we are at the outset faced with a problem the existence of which is not generally realized, namely, the impossibility of determining the exact cost of hauling any particular commodity or class of traffic, or performing any particular service. This is owing to the extraordinary difficulty—virtually an impossibility—of debiting any class of traffic with its exact share of overhead charges,

> which make up a large percentage of total railway expenditure. It is not even feasible to effect an exact allocation of total working costs as between passenger and goods traffic, since so many forms of expenditure, such as track maintenance, signalling, and general administrative charges, are common to both. At best any allocation can only be approximate and to some extent arbitrary. . . .
>
> . . . It is conceivable that a very detailed system of accounting might show with reasonable accuracy how much of the total cost of locomotive power, including depreciation, should be debited to passenger and goods traffic respectively, but the cost, time, and labour involved would be out of all proportion to any benefits that might accrue from the compilation of such statistics. Moreover, they would still fail to indicate the cost of carrying any particular class of traffic. In regard to such forms of expenditure as signalling, track maintenance, and supervisory charges, even the most meticulous compiling of statistics would not enable costs to be allocated with entire accuracy.[1]

Again, Professor Hammond, in his well-known work on *Railway Rates*, by using the word 'impracticable' in the paragraph quoted below, leaves open to doubt the sense in which he intends his readers to understand the term 'overhead cost', although his reference to joint costs in the second paragraph may perhaps be taken as settling the matter in favour of the stricter interpretation:

> In the business of railway transportation, with its large proportion of fixed to circulating capital, it is impracticable to determine the costs of performing any particular service or of transporting any particular commodity. . . .
>
> If the theory of cost of service is to be employed in explaining the principles of railway charges, the term cost must, undoubtedly, be used in the sense of joint costs.[2]

The distinction between prime and overhead costs depends largely, of course, upon the way in which 'unit of commodity' is defined. The cost of the coal used in drawing a train from London to Liverpool is an overhead cost of the service of carrying individual passengers but a prime cost of the service of running individual trains on that route. Again, 'some costs which would have been classed as prime costs in relation to contracts, or other affairs, which lasted over a long period, would be classed as supplementary [or overhead] costs in relation to a particular affair which would last but a short time, and which came under consideration when business was slack.'[1] In fact costs may be regarded as either prime or overhead according to the type of commodity-unit to which they are related.

---

[1] Quoted by Mr. F. J. Alban in *Public Administration*, vol. iv, pp. 402–3.

[2] M. B. Hammond, *Railway Rate Theories of the Inter-State Commerce Commission*, 1911.

Whenever overhead costs are incurred, there exists 'no rule of Nature' (in the late Professor Marshall's phrase) by which we can determine the proportions in which to divide them among the various commodity-units.[2] This fact is illustrated by the following oft-quoted analogy from Sir William Acworth's book on *The Railways and the Traders*:

> A doctor keeps a carriage. Sometimes he drives one horse, sometimes a pair. Some of his patients live close round the corner, others several miles off. At one time an epidemic brings on his hands half-a-dozen cases in adjoining houses. At another the sickness is distributed in all directions throughout his district. Once or twice a week his wife borrows the carriage to visit her friends. At the end of the year the doctor, after making an estimate—and it can only be an estimate—of the depreciation of horses and carriage, finds that his stable has cost him, say, £250. So far so good, but supposing he is asked what percentage of a particular patient's bill is due to what we may call, in American phrase, 'transportation expenses', will he not reply that the question is unanswerable?[3]

Nevertheless, the doctor has to find some sort of an answer to this 'unanswerable' question. Three sorts of answer are possible.

---

[1] A. Marshall, op. cit., p. 420.

[2] It is unfortunate that Professor Pigou should have constructed an example in such a way as to imply that overhead costs may legitimately be divided by arithmetical averaging. In *The Economics of Welfare*, p. 294, demonstrating that 'simple competition, or the cost of service principle, involves different charges for electricity supplied at different times', he makes the assumption that this is true only if different quantities of electricity are demanded at different times, and divides the cost of the equipment needed for producing a constant 1½ million units per hour throughout the day among peak and off-peak customers in direct proportion to their share in the daily 36 million units. Professor Pigou himself testifies elsewhere to the illegitimacy of this proceeding, by stating: (i) that 'when two or more commodities or services are the joint result of a single process, in such wise that one of them cannot be provided without facilitating the provision of the other, simple competition evolves, not identical prices per pound (or other unit) of the various products, but prices so adjusted to demand that the whole output of all of them is carried off' (op. cit., p. 296); (ii) that 'the concept of joint supply can, if desired, be applied to the same services rendered at different times by the same fixed plant. . . . This consideration is especially important with electricity rates. It justifies differentiation of a form designed to carry off nearly equal supplies throughout the day or year' (op. cit., p. 300 n.).

[3] W. M. Acworth, *The Railways and the Traders*, 1891, p. 18.

1. The most obvious course is to 'divide the £250 by the total number of visits he has paid in the twelvemonth, and say that the result is the cost of each visit'.[1] For reasons given below,[2] the doctor would be unlikely to adopt this method of allocation; but he would at least find it a practicable method. Other undertakings, with more complex conditions of production, might find it not merely unprofitable but impossible. The doctor could divide the overhead costs of his carriage equally among the units of the commodity produced with its aid, because this product may be regarded as homogeneous, as consisting of similar units called 'visits'. But many undertakings produce commodities that cannot by any stretch of the imagination be regarded as homogeneous. 'Take, for instance, the miscellaneous goods train which conveys traffic of all kinds, including one wagon of copper ore, another wagon of furniture, another of potatoes, and so on through 50 or more wagons, how is the engine cost to be distributed as between the copper ore and the furniture or potatoes? How are the signalmen's wages at the signal-box the train passes when on its journey to be allocated to the different commodities using the line? How, indeed, are the signalmen's wages going to be divided as between goods and passenger trains that pass his signal-box, or how is the cost of upkeep of permanent way going to be divided as between train and train, say, as between goods and passenger train or even between one goods train and another?'[3] How, again, is the retail grocer to divide his overhead costs among the pounds of sugar and tea and coffee and rice, the jars of jam and pickles, and the tins of preserved fruit and condensed milk that he sells?

2. He might, of course, adopt some more or less arbitrary common measure for his commodities and divide his overhead costs among them in proportion to their weight or volume or wholesale price. Similarly, railways might divide their overhead costs in proportion to the weight of goods (and passengers) carried, or in proportion to the space which they occupy, or in proportion to the prime cost of carrying them (which is usually a very small sum indeed). But as the apparent homogeneity of the products gets less and less, the arbitrariness of this method becomes more and more obvious in correspondence with the increasing difficulty of finding a common measure of all the commodities. This difficulty is so

---

[1] W. M. Acworth, *The Railways and the Traders*, 1891, p. 18.

[2] pp. 68–70.

[3] P. Burtt, *Railway Rates*, London, 1926, p. 77.

great and the arbitrariness so obvious in some types of undertaking, that no pretence at all is made to a 'scientific' division of their overhead costs.

Where a system of costing which divides costs on some apparently arbitrary basis (such as prime cost or weight) proves satisfactory in practice, the explanation may fairly be sought in one of the following sets of circumstances:

(i) The 'overhead costs' so divided are not overhead at all in the sense of the definition on pp. 62–3. Thus the division of the cost of cleaning a block of offices among various single offices on a basis of floor area may be in fact nothing less scientific than a method of estimating directly the *prime* cost of the service. Or again, the division of the 'overhead' cost of *wear-and-tear* depreciation of a machine on a basis of working hours may be simply a straightforward allocation of prime costs.

(ii) When the costs concerned really are overhead costs, a successful 'arbitrary' division of them will usually be found to be nothing more or less than a disguised application of the third method of allocating costs, described below. That this is frequently the case is suggested by the fact that methods of distributing overhead costs are often modified from time to time according as the burden placed upon particular departments or products is found to be 'too heavy'—i.e. more than 'the traffic will bear'.

3. This third method is, in railway parlance, that of 'charging what the traffic will bear', i.e. that of charging the heaviest share of the overhead costs to those customers who can most easily be induced to pay it. The method has often been denounced as amounting to little more than highway robbery; and yet, as will be seen, it is not only justifiable but, properly understood, inevitable. 'It is the system which—the point must be reiterated—is, always has been, and, as far as we can see, always must be adopted on all railways, whether they be State enterprises or private undertakings.'[1] And the necessity for its adoption is not restricted to railways.

It is, however, important to define exactly what the phrase 'charging what the traffic can bear' implies. It means nothing more than adjusting the burden of the overhead costs according to various consumers' capacities to pay; or, in technical language, than distributing overhead costs in inverse proportion to elasticities of demand. Hence, when speaking of modern railway rates, Sir William Acworth was to some extent justified in declaring that the principle is one, 'not of extortion, but of moderation. To charge what the traffic can bear is, in other words, not to charge what the traffic cannot bear. Yet the phrase is commonly understood quite differently.'[1] 'Had railway managers in the past declared that their principle was "tempering the wind to the shorn lamb", their descriptive accuracy would have been equally great, while their popularity might have been even greater.'[2]

---

[1] W. M. Acworth, *Elements of Railway Economics*, p. 77.

It is possible to follow Sir William Acworth in recognizing three advantages which this method has over all other methods of distributing the burden of overhead costs.

1. The first of these advantages is that the method is 'in the interest of the railway, because even the lowest class traffic, by whatever small amount its rates exceed the additional cost of doing the business, contributes to the general expenses of the undertaking.'[3] To look at the matter from another angle, the system of charging what the traffic will bear, or of distributing the overhead costs according to elasticity of demand, permits a closer approach to complete utilization of the resources of an undertaking than any other method would permit. The railway management, for instance, 'has a certain object in view—to keep the system well occupied, on the principle that the greater the turnover the lower the average of dead charges per unit of the thing "produced",' which in this case is transport.[4] 'The principles underlying this policy—a policy which, be it once more repeated, is common to all railways, whether owned by the State or by private companies—may be said to be three:

'I. Get traffic. The more traffic carried, the less it costs to carry.[5] Therefore, first and foremost, get traffic.

---

[1] W. M. Acworth, *Elements of Railway Economics*, p. 75.

[2] Ibid., p. 76.

[3] Ibid., pp. 77–8.

[4] A. W. Kirkaldy and A. D. Evans, *The History and Economics of Transport*, London, 1927, p. 151.

[5] This sentence needs qualification. It holds true only so long as the undertaking possesses idle capacity which the extra traffic can utilize. Eventually a point must be reached at which the carriage of a little extra traffic may involve the railway in very heavy additional expenditure, on extra track or terminal accommodation, for instance. At such a point it is obviously not true that 'the more traffic carried, the less it costs to carry'. As Professor Clark suggests (*The Economics of Overhead Costs*, 1923), it is possible that railways (and, we would add, other public utilities) sometimes forget this fact and proceed to incur heavy additional costs on account of traffic that would have paid its prime cost under

'II. Charge no rate so high as to stop the traffic from going:[1] subject to

'III. That no rate shall be so low as not to cover the additional cost incurred by the railway in dealing with the traffic to which the rate applies.'[2]

Similarly in the electricity industry, 'the economic foundation for differential rates is the desirability of more fully utilizing a fixed-capital investment through the granting of specially low rates to business that can only so be obtained. Fixed capital is seldom or never utilized to its full capacity throughout a specified period, for example, a year.'[3] 'An electric rate schedule . . . should promote the expansion of business and the extension of the use of the service to the limit of what is economical from the viewpoint of society as a whole. No class of business that can be handled at a profit should be despised.'[4] 'The consumer ought to be given an inducement to promote the lowering of cost. . . . Differentiation with a view to maximum service is needed.'[5]

---

the old cost conditions, but does not pay its prime costs if these are reckoned to include the additional capital expenditure which it necessitates. (Perhaps the substitution of 'special' for 'prime' in the second place in which that word occurs in the last sentence, in accordance with Edgeworth's usage, would draw attention to a useful distinction.)

[1] This sentence also needs qualification. 'For the market will bear a great many prices though it will contract its demand as the price rises' (Marshall, *Industry and Trade*, London, 1920, p. 405). As this canon stands it would be admissible only if each item of traffic were to be bargained for separately, and this is the case in modern public utility industries only if 'item of traffic' be given a somewhat unusual definition. 'The most important unit is the single business decision, and whatever volume of business may be governed by it' (Clark, *Overhead Costs*, p. 213); and if this definition be adopted, Acworth's second canon ceases to have any meaning, since the size of the 'item of traffic' will now depend on the very rate that is to be determined by it. This canon, in fact, is only applicable to cases of discrimination of the first degree, i.e. cases where a different price is charged 'against all the different units of commodity, in such wise that the price exacted for each was equal to the demand price for it, and no consumers' surplus was left to the buyers' (Pigou, op. cit., p. 279), whereas the only sort of discrimination that is practicable in the public utilities is discrimination of the third degree, i.e. where the seller distinguishes 'among his customers *n* different groups, separated from one another more or less by some practicable mark', and charges a separate price to the members of each group (ibid., loc. cit.). Perhaps Acworth's second canon could be better expressed thus: 'Charge no rate so high as to bring in less net revenue from the traffic to which it applies than a lower rate would bring in.' See Marshall's discussion of this point in *Industry and Trade*, pp. 404-5.

[2] W. M. Acworth, *Elements of Railway Economics*, p. 71.

[3] Watkins, *Electrical Rates*, New York, 1921, p. 191.

[4] Ibid., p. 211.

[5] Ibid., p. 218.

The benefits made available by the fuller utilization of the capacity of an undertaking due to charging 'what the traffic will bear' may, of course, be enjoyed solely by the undertaking in the form of extra profits or may be returned in whole or part to the consumers in the form of cheaper or better service.

2. The method of charging what the traffic can bear is obviously of advantage to those consumers who pay the lowest prices, and who, under any other conceivable system, would not be able to afford to buy at all.

3. And even the traffic which pays the larger share of the overhead costs benefits more by the arrangement than it would by any other, 'because everything which the low-class traffic pays beyond its own actual out-of-pocket cost helps to defray the general expenses of the undertaking, which otherwise the high-class traffic would have to bear unaided'.[1]

The net result of these factors is that whenever it is practicable to do so, sellers endeavour to allocate their overhead costs according to this third method. It is not always possible for them to do this. Conditions of demand which are decisive in this matter may force them to adopt some less 'discriminatory' method. But if conditions of demand permit and in the absence of authoritative prohibition, the cost-structure of an undertaking may be expected to exercise an important influence on its pricing processes.

For every undertaking has its individual cost-structure, a peculiar manner in which its costs overlap and rest on each other and form pyramids. And any attempt to understand the pricing processes of an industry without reference to the peculiar characteristics of its typical cost-structures is hopeless from the outset.

Probably the only costs that may be rightly regarded as overhead for all the units of commodity produced during the whole lifetime of a water-supply undertaking are those which are incurred once for all in connexion with its establishment. The legal and financial expenses of company promotion, the legal and parliamentary expenses of securing a charter, the prices sometimes demanded for 'franchises', 'goodwills', and 'concessions', are examples of this kind of cost. They are on the whole likely to be smaller in public than in private undertakings. Certain other costs may be overhead for all the water supplied during a long period, although not necessarily so long a period as the whole life of the undertaking. Examples are: the rent paid for land, interest on capital used for purchasing land, interest on capital used for acquiring relatively durable plant, depreciation charges on such plant, and the like. Waterworks often incur a large proportion of such costs for reservoirs, wells, and drainage and catchment works. Similar charges incurred on account of less durable plant, such as machinery which is liable to wear out or become obsolete, are overhead for the product of still shorter periods. The salaries and other expenses of the technical and administrative departments will normally be overhead costs with regard to yet shorter periods. It is possible to construct a further scale, passing through the wages of regular and then temporary labour, to costs which are overhead for very small batches of product. In waterworks undertakings, hardly any costs will be found to be truly prime, if the gallon or cubic meter be taken as the commodity-unit.

---

[1] Acworth, *Elements*, p. 78.

Profits, in the case of a privately owned public utility, are usually a fairly fixed sort of interest on capital, and form part of the major overhead costs for most purposes. Many German municipal undertakings also seek a profit in this sense, and indeed are required to make such a profit for the benefit of the city exchequer. Where the undertaking is required to earn a fixed sum, decided upon by the city council on purely budgetary principles, this profit might seem to belong to the general overhead costs of each financial year; but if it is based, as it frequently is, on an estimate of the year's output, it becomes in effect very similar to a tax on each unit of output and should for most purposes be reckoned as a prime cost.

But although few costs are prime in water-supply undertakings, few costs are overhead for all the units of commodity being produced at any given time. The promotion and other foundation expenses already referred to are overhead in this widest sense, since they normally have to be incurred whatever output is contemplated. Again those costs which are incurred for collection and filtration may be overhead, within certain periods, for the whole supply. The cost of a service reservoir is overhead only for those gallons of water which pass through it (or rather, to be strictly accurate, for those which are liable to pass through it). The costs of the mains in any particular street are overhead only for the gallons of water supplied to that street (unless the mains in question convey water to other streets as well). And the costs of the pipes, taps, meters, and other fittings, in a single house are overhead only for the supply to that house.

Adherence to the principles of 'free competition' demands that costs should be charged to those groups of units to which they can be traced; but it makes no demands and affords no guidance whatever for their division among the units composing such groups.

It has been pointed out that a large proportion of such untraceable or overhead costs are incurred by water-supply undertakings. This is due partly to the technical nature of the industry, and partly to the need for planning extensions long before an anticipated increase in demand actually comes into being. 'In scarcely any other industry is it necessary to look so far ahead in order to provide an adequate supply as in the case of water. In a year or two the output of most undertakings can be doubled or trebled, but to secure an additional supply of water to a town, ten or more years of continuous work may easily be required. . . . A further point of great importance is that whereas the size of an ordinary business can be increased by small increments, this is frequently not possible in the case of a water undertaking. To secure a comparatively small quantity of extra water it may be necessary to undertake a large and costly scheme of extension, which will either involve a great increase in the price of water for many years to come, or a very heavy financial loss.'[1] These facts make the private ownership of waterworks comparatively unusual, and with public ownership goes the increased possibility of 'social' as distinct from purely 'economic' influence on the tariffs. A more important and direct influence is examined below in connexion with the discussion of prime costs.

On p. 71 it was mentioned that certain overhead costs of water undertakings—e.g. the costs of taps, meters, and rendering accounts—can be traced to individual customers but not to separate gallons of water. These costs, which are often called 'customer costs', are to be met with in most industries, but they play an unusually important part in the public utilities. Their chief effect is to make it proportionately cheaper to supply a large number of units of commodity to a single customer than to supply a small number. This means that if water-prices are to be determined as far as possible according to cost, small consumers will in general pay a higher price per gallon than large consumers.

In the water-supply industry the prime costs are less important than in other public utility industries. Little labour is required, the principal raw material is not purchased in stated quantities, and, with a given plant, the cost of the processes involved does not vary appreciably with the amount of water subjected to them. Thus the proportion of the costs that can be directly assigned to separate gallons of water, or even to separate customers, is small, and a large field remains for the exercise of arbitrary power in the distribution of overhead costs. But in the water-supply industry, public opinion generally demands an equal distribution of overhead costs among all gallons of water, however and to whomever sold, and thus the 'natural' tendency to extensive differentiation in this industry is counteracted. This is illustrated so far as Germany is concerned by the facts given in the latter part of Chapter V.

---

[1] Knoop, *Municipal Trading*, p. 38.

Finally, it should be noted that the average household spends considerably less on water than on gas or electricity,[1] and that any

---

[1] This fact is illustrated by the following table, compiled from statistics given in *The Municipal Year Book*, 1930, and the *Statistisches Jahrbuch deutscher Städte*, 1930, and from information kindly supplied by the directors of the Vienna and some of the German undertakings:

TABLE XIX

Average Expenditure on Utility Services

	Approximate expenditure of population in English shillings per head during 1928 on			
City	*Water*	*Gas*	*Electricity*	*Trams*
Glasgow .	9	34	27	42
Birmingham .	17	48	34	29
Liverpool .	14	34	32	35
Manchester .	22	39	44	47
Sheffield .	16	28	33	35
Average of British cities .	*16*	*37*	*34*	*38*
Berlin . .	7	22	33	29
Hamburg .	7	20	40	29*
Cologne .	10	14	43	37
Munich . .	8	14	32	42
Leipzig . .	6	16	34	42
Dresden .	9	17	34	42
Breslau . .	7	19	25	28
Frankfort .	12	20	40	41
Average of German cities .	*8*	*18*	*35*	*36*
Vienna . .	6	18	27	35
General average	11	25	34	37

* With Altona.

This table does not give a true picture of personal expenditures, since it includes given addition to customer charges will therefore mean a much greater relative addition to the price of water than to that of gas or electricity. This is a strong argument against the use of meters for registering the consumption of water, especially where the total consumption is small. There are, however, strong arguments on the other side of the question also.

(*b*) *Measurement of the Commodity.*

Water is a commodity that is easy to standardize and measure. It thus presents few difficulties with regard to the unit to be charged for, either quantitatively or qualitatively. The importance of this fact is brought into prominence by consideration of the totally different conditions in the gas, electricity, and tramway industries. Its chief effect upon tariffs is probably to make for the minimum of price-differentiation, since the public is likely to have great difficulty in regarding the commodity of which it is true as anything but homogeneous, and is consequently liable to regard all price-differentiation as unfair.

(*c*) *Structure of the Market.*

Even when supply conditions make it profitable to charge different prices—and there are few undertakings which do not incur overhead costs—demand conditions may not make it possible to do this. Briefly speaking, it may be said that differential prices can be charged only when the goods between which it is desired to differentiate can be sold in different markets. But 'markets' here must be understood in the special sense of the economist,[1] not in the general sense of the lexicographer.

Where the commodities between which it is desired to differentiate are different kinds of commodity in the eyes of the consumers, this separation between markets is automatically achieved. It is possible to charge one price for a pound of wool and another for a pound of mutton without people wishing to exchange wool for

---

industrial as well as private and domestic consumption. Again, whereas practically every household in the above cities is connected to the water supply, not every one is connected to the gas and electricity supply. These facts preclude the possibility of detailed arithmetical comparisons, but they do not invalidate the broad conclusion that the average household spends more on gas and electricity and tramway rides than on water.

[1] Even economists use the word in different senses. For our present purposes the market in a given commodity for a given buyer may be defined as that sphere within which units of the commodity are commercially accessible to the buyer.

mutton or to buy wool instead of mutton, because consumers do not regard a pound of mutton as perfectly interchangeable with a pound of wool. But the attempt to charge different prices for different commodity-units in markets that are not separated by this or any other 'natural' barrier is likely to be frustrated by arbitrage on the part of buyers unless it is possible to erect artificial barriers between the markets. Such artificial separation is most easily attainable when the seller has a complete monopoly, but may exist where there is any degree of what we may call *polypoly*, to revive an old German term.[1] Its existence would be rendered impossible by the presence of two sets of conditions.[2]

1. The first of these conditions is the costless transferability of commodities from one consumer to another. When this exists it permits those who would otherwise have to buy at the higher prices to purchase more favourably at second-hand from those customers who are granted the lower prices. Thus the sales at the lower prices would constitute the only business of the original vendor, who would thereupon be compelled to recoup himself by raising prices. So forces would be brought into operation which would tend to establish a uniform distribution of the overhead costs. Costless transferability of goods among customers seldom exists; but in many cases a sufficient degree of transferability exists to make it scarcely worth the vendor's while to charge differential prices. Retail shopkeepers often manage to charge different customers slightly different prices for similar goods, but if the differentiation were carried beyond a certain limit it would defeat its own ends.

There are two common causes of non-transferability of commodities. One of these is the nature of the commodity, when it is a service applied directly to the person or dwelling-place of the consumer. The services of medical treatment, personal portraiture, personal transport, and the like are absolutely non-transferable between consumers. The services of electricity- or gas-supply are transferable with ease among a strictly limited number of consumers—the inhabitants of a single house for instance—but transferable only with considerable difficulty beyond the limited circle.

---

[1] Used by J. J. Becher in his *Politischer Diskurs*, 1668. But Becher's meaning was rather different from what is intended above, viz. the presence of more than one and less than an infinite number of sellers in a market.

[2] See A. C. Pigou, op. cit., pp. 275 ff., the *locus classicus* on this subject.

Sometimes the conditions which exist are not directly those of non-transferability between customers, but those of non-transferability between material objects belonging to customers. Thus the services of boot-cleaning, of fence-painting, or of carrying letters, are completely non-transferable from one subject to another. It is impossible to have a fence painted and then transfer the painting of it to another fence, or to have a letter sent from London to Edinburgh and then transfer the carrying of it to a postcard. In this case an effective system of price-differentiation would of course differentiate not between customers but between objects. Railways apply this principle when they charge different rates for transporting coal and copper; and the post office when it charges one rate of postage for a card with a personal message on it and another rate for a card bearing only a conventional greeting.

Another cause of non-transferability is the prohibition or hindrance of transfers by law or contract or by expenses connected with transport. Thus it is sometimes possible for a firm to sell goods cheaper to foreign than to home consumers because the re-importation of the goods involves the payment of a heavy duty.

2. A second circumstance that would hinder the charging of differential prices is the difficulty of conducting the business of selling so that different customers pay different prices. In the small retail trade, where each sale is more or less a personal bargain between vendor and consumer, it is quite easy to charge some customers more or less than others. But most modern selling is, like most modern production in the narrower sense, conducted on a large scale. And large-scale selling does not favour individual bargaining. An illustration of this fact may be seen in such countries as Italy, where it is on the whole the bigger shops that have *prezzi fissi* and the smaller ones that still bargain separately with each customer.

Sometimes, however, it is possible to adopt a middle course and to divide customers into classes such that, while all the members of any one class pay the same prices, the members of different classes pay different prices. Football clubs adopt this expedient in charging ladies and schoolboys half-price for admission to their grounds. The method fails if it is possible for a customer to transfer himself from one group to another, or even successfully to pretend to have done so. The 'half-price for ladies and schoolboys' system would not work, for instance, if it were practicable for some spectators to become schoolboys or disguise themselves as ladies on Saturday afternoons. Similarly it would not be a very successful plan simply to charge a shilling for admission to all who entered by one gate and two shillings to all who entered by another, if both gates were equally accessible to all and led to the same parts of the ground; for in such circumstances the majority of the spectators would simply enter by the cheaper gate and the higher price of admission would remain virtual only, except of course for those who cared to pay the extra shilling in order to show that they could afford to do so, or in order to avoid the crowd.

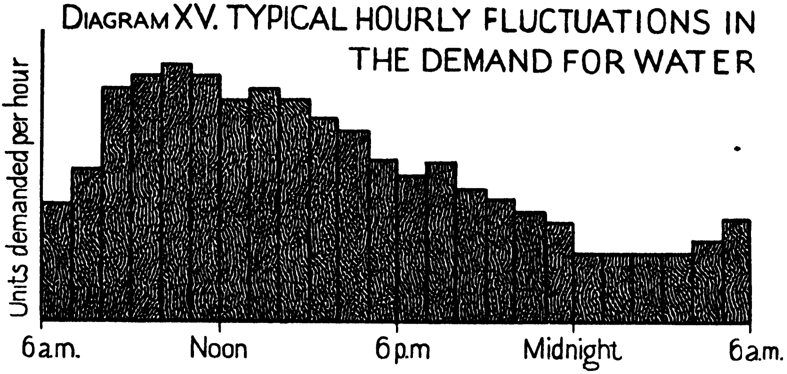


DIAGRAM XV. TYPICAL HOURLY FLUCTUATIONS IN THE DEMAND FOR WATER

The degree to which an ordinary water undertaking's market is split up by 'natural' factors is not very great. As has been pointed out, the commodity is one that is generally regarded as homogeneous, and by an easy transition the service of supplying it is on the whole regarded as homogeneous also. The chief distinction that consumers feel to be important is that based on the *time* at which the water is supplied.

The domestic consumption of water, when compared with that of gas, electricity, or tramway services, is more or less evenly spread out over the day, week, and year. The public demand, for fountains, street cleaning, public baths, &c., is usually as regular. The industrial demand depends on the nature of the industries concerned, but will in general be regular throughout the year and the five and a half working days of the week, and throughout the working day, or even day and night. The diagram above shows typical fluctuations of demand for water throughout a normal day.

From such diagrams as this may be constructed the less accurate but more useful diagrams which are known as load-curves. The following load-curves show typical daily, weekly, and annual fluctuations in the demand for water in a large city.

The highest parts of a load curve are called peaks. The load-

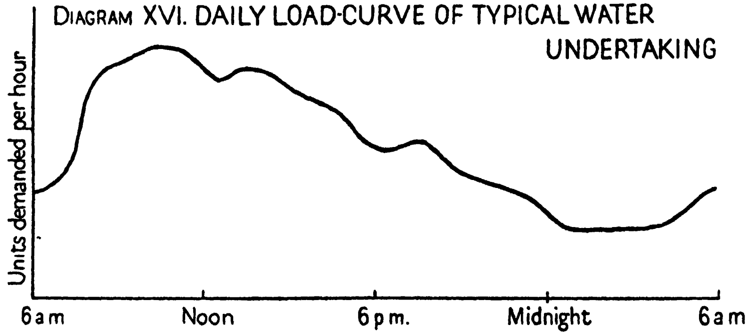


DIAGRAM XVI. DAILY LOAD-CURVE OF TYPICAL WATER UNDERTAKING

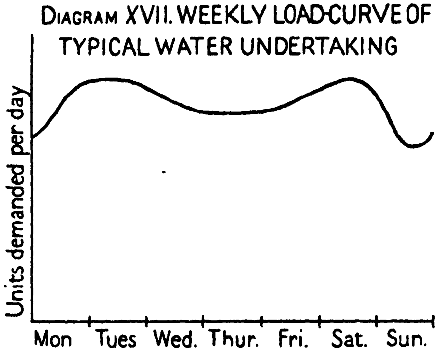


DIAGRAM XVII. WEEKLY LOAD-CURVE OF TYPICAL WATER UNDERTAKING

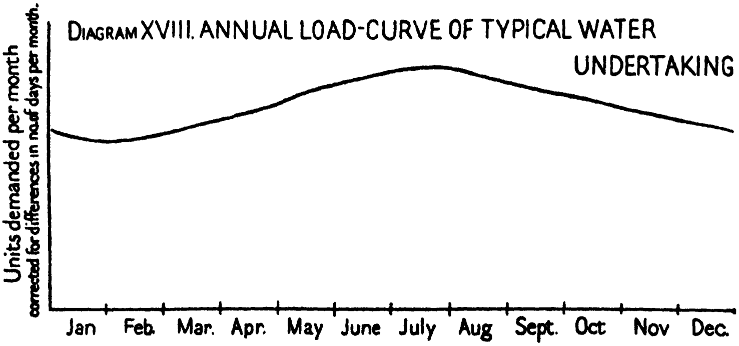


DIAGRAM XVIII. ANNUAL LOAD-CURVE OF TYPICAL WATER UNDERTAKING curve terminology was first employed for dealing with certain problems in the electricity industry, but it may be equally well used for dealing with similar problems in other industries, for 'this idea of peak loads, and of waste through irregular utilization, has come to apply to practically every industry in some form or other. Restaurants, theatres, golf-clubs, garment-making industries, railroads and street cars, building and other trades—all have their peaks, daily or seasonal. And all industries suffer in common from the unpredictable irregularities of the business cycle.'[1]

From the schedule of which the load-curve is a graph may be calculated two extremely useful coefficients. The first of these is the Load Factor. 'The Load Factor of a machine, plant or system' is the 'ratio of the average power to the maximum power during a certain period of time'.[2] Thus we may calculate the load factor of an electrical generating plant, of all the electrical undertakings in Great Britain taken together, of the electrical installation in a single house, or even of a single piece of electrical apparatus, such as a lamp. When the amount of power demanded or generated or transmitted does not vary at all over the period under consideration, the load factor is 100 per cent.

It is obvious that similar factors can be calculated with regard to the water supplied by a waterworks, or taken from a tap; or with regard to the gas generated by a given plant or consumed in a given installation; or with regard to the number of passengers using a tramcar or a whole tramway system; or with regard to the number of calls at a telephone exchange.

The second useful coefficient referred to above is the Capacity Factor. In its most general form this has the same numerator as the load factor but takes as its denominator the capacity of a machine, plant, or system. Where the machine, plant, or system at any time runs at full capacity (i.e. when the maximum power equals the capacity) the load factor and the capacity factor are identical; and of course the capacity factor can never really be higher than the load factor, although the common practice of under-estimating true capacity in the rating of plant permits demand on occasion to rise above (rated) capacity, and the correct relations of the two factors may thus be disturbed.

---

[1] J. M. Clark, *Overhead Costs*, p. 15.

[2] Standardization Rules of the American Institute of Electrical Engineers, 1916, quoted Watkins, *Electrical Rates*, p. 12.

The capacity factor of a given electrical plant is defined by the American Institute of Electrical Engineers under the name Plant Factor as 'the ratio of the average load to the rated capacity of the power plant, that is, to the aggregate ratings of the generators'.[1] If a plant were therefore constantly utilized to its full capacity over a given period, its capacity factor for that period would be 100 per cent. Since this factor is rather an indication of utilization than of capacity there is much to be said for calling it the Utilization Factor. The terms Capacity Factor and Plant Factor are those which are in general use, however.

But the above apparently straightforward definition conceals difficulties. Any working definition of 'capacity' must necessarily be somewhat arbitrary. 'What is the "capacity" of a plant? Business men use the term constantly, and yet no absolute figure can ever be set. The term never means the utmost limits to which production could be pushed; there is always some "overload capacity".'[2] The difficulty is still greater when it is the capacity, not of a plant, but of a whole undertaking, that we wish to define. Owing to the fact that men, much more than machines, need variety in and rest from their work, the capacity of an undertaking—which is a complex organization of machines and men—must always remain a matter for opinion rather than measurement. 'For practical purposes, capacity must be measured according to what is a customary length of working day for the machinery, which may be anything from eight hours a day to twenty-four.'[3]

When the capacity of an undertaking is thus defined, but not otherwise, we may assume that the ideal capacity factor for the undertaking will be 100 per cent. It is important to note that this by no means implies a capacity factor of 100 per cent. for any of the factors of production of the undertaking, or for any group of such factors of production—for the generating plant, or distribution system, or clerical staff, for instance.

In such a diagram as the following, let the line LL' be the load-curve of an undertaking during a given period ON, and let the perpendicular distance from ON to CC' be the capacity of the undertaking at any point of time during the period ON. Then the height MP will represent the maximum demand or peak load on the undertaking, and the area $OLL'N$ will represent the total load on the undertaking and the area *OCC′N* the total capacity of the undertaking during the period *ON*. Suppose *DD′* drawn parallel to *ON* through *P*. Then the ratio of the areas *OLL′N*: *ODD′N* will be the load factor of the undertaking and the ratio of the areas *OLL′N*: *OCC′N* its capacity factor for the period *ON*. It is obvious that if *CC′* coincides with *DD′*, i.e. if capacity is constantly equal to maximum demand in the period *ON*, the two factors are identical.

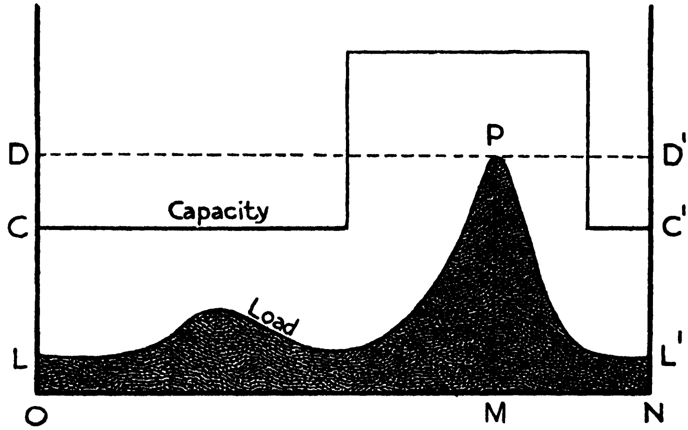
---

[1] Cited by G. P. Watkins, *Electrical Rates*, p. 13.

[2] J. M. Clark, op. cit., p. 90.

[3] Ibid., p. 91.

DIAGRAM XIX. LOAD FACTOR AND CAPACITY FACTOR



The most important result of the steady nature of the typical demand curve for water, apart from its influence on costs,[1] is to render less striking the automatic divisions of the market that are based on the factor of time.

But so far as they enjoy a polypolistic position water-undertakings are able to impose certain other divisions on their market to serve as a basis of price-differentiation, if they so desire. Now even in the absence of such complete or partial monopolies as are commonly given them by government authority, water-undertakings are likely to enjoy a high degree of polypolistic power, because of the technical conditions under which water-supply is carried on. Chief of these is the necessity for a large and expensive 'octopoid' plant, which, once installed, acts both as a physical and an economic deterrent to the installation of competing plants.

Possessing considerable polypolistic or even monopolistic power over their markets, water-undertakings are economically—if not politically—free to impose any classifications on their customers that they desire, subject only to the qualification that customers must not be able to move easily from one group to another, nor easily to re-sell the services which they buy from the undertaking.

---

[1] See pp. 60–74, above.

Where small quantities are in question this second sort of non-transferability is automatically secured by the difficulty or inconvenience of transporting water except through pipes. And where the quantities concerned are large enough to make the construction of pipes worth while, non-transferability is usually secured by authoritative or contractual prohibitions of re-sale.

Water-undertakings are able to secure non-transferability of customers between groups chiefly by taking advantage of the 'natural' distinctions between consumption for different purposes. Favourite classifications of this sort distinguish between domestic and industrial and between private and public consumption. But the scope for this kind of division is much more limited than in the other public utility industries.

In the case of domestic consumption of water, not only is the rate of consumption fairly constant, but the total quantity consumed over any period by a household of a given type does not usually differ considerably from that consumed during the same period by any other household of the same type. This fact makes it possible to estimate with a fair degree of accuracy the consumption of water in any house of which the number of rooms or the floor area or the rateable value or rent or some similar measurable characteristic is known. This is of great importance when it is desired to dispense with a meter and rely upon estimates as a basis for charges.

This comparative inelasticity of demand for water for domestic use is to some extent offset by the comparative facility with which water may be wasted. There is thus a strong case for charging for water supplies by meter, which gives the consumer a financial interest in the prevention of waste, rather than by estimate, when the supplier alone is so interested.[1] When the method of charging

[1] When the first modern supply of water was given in Halle no charge was made for domestic supplies. 'But difficulties soon arose. In their delight at the good water, which was supplied to them free of charge, the townspeople made much too free a use of this municipal gift—many housewives even let the tap run night and day continuously (so that the water would always be nice and fresh!)—with the result that more than four cubic feet per head per day was soon

by estimate prevails, as is usual in Great Britain, the supplier's interests have to be protected by making waste punishable and instituting complicated tests for detecting it. It is said that in America the introduction of meters invariably leads to a considerable reduction of consumption, but it is impossible to say whether this reduction—which is sometimes as great as 50 per cent.—is due to greater attention to leaky taps or to greater economy of use, in the garden for example.

Estimates of domestic consumption of water are of course liable to be greatly disturbed by the use of supplies for garden or garage purposes or for fountains, to take a few examples for which many water-tariffs make provision. It is therefore customary, where estimates of consumption are made, to reckon an additional quantity for such 'outside' uses. In any case it is only domestic consumption that shows this tendency to vary with the size of the building to which the supply is given. If the unusual course were taken of charging according to estimate for industrial consumption, quite a different method of assessment would have to be employed.

The fact that domestic consumers must have a certain daily supply of water at all costs has naturally an important bearing on the amount of power which a monopolist supplier would possess, and this in its turn affects the arguments both for public management and for and against discrimination.

(*d*) *Conditions of Storage.*

Water is not pumped direct from the filter-beds or wells to the consumer, but first passes through a service reservoir. One of the chief reasons for this arrangement is the fact that whereas the demand for water varies from hour to hour and from day to day and from week to week, the supply of water from the pumps is most cheaply secured when it is carried on at a steady rate, or at least when it varies according to circumstances that have nothing to do with demand. Some method of bridging the gap between supply and demand is therefore required, and for this purpose the service reservoirs are used.

The proportions between storage capacity and demand vary with local conditions and will in particular be high if there is a special danger of supplies being interrupted through drought,

---

being consumed. It was therefore necessary to check this by charging' (*Werke der Stadt Halle Aktiengesellschaft: Denkschrift*, Sept. 1st, 1929).

aqueduct breakdown, or the like; but in general it may be said that the main service reservoirs will hold not less than one day's supply and perhaps as much as a week's. If the pumps do not work continuously throughout the day, the service reservoirs need to be larger than when they are replenished uninterruptedly.

Since it is possible to store water in this manner, daily and hourly fluctuations of demand are not of great importance to water undertakings, apart from the fact that such fluctuations necessitate expenditure on the construction and upkeep of service reservoirs. But since these reservoirs would be required in any case to provide against accidental failure of supply, their cost is not likely to be charged to any particular group of consumers. The extra demand in summer is of a rather more serious nature, however, since it makes a much larger drain on the undertaking's resources and comes at a time when water may be more than usually difficult to obtain. Consequently, in districts where the summer demand is abnormally high, or the summer supply abnormally restricted, an attempt is sometimes made to level out the demand by charging higher prices in the summer than in the winter.

(*e*) *Area of Supply.*

Water shares with gas, electricity, and tramway services, the characteristic of being sometimes supplied by a local government authority to districts outside its own area of jurisdiction. In such cases the question arises whether the consumers situated outside the boundaries should be charged exactly the same as those inside or not. There is much to be said on both sides of this question. 'Probably the most common argument in favour of making higher charges outside than inside the municipal boundaries is that the municipality provides the capital and takes all the risks involved, and is consequently entitled to compensation in the form of higher prices from people living outside the local area who do not share in the risks. Another reason put forward is that to supply people living in outside areas is likely to be more costly than to supply the inhabitants of the town itself. The farther the consumers are from the distributing centres—gas-works, generating stations, or service reservoirs—the longer the length of mains to be laid and the greater the expense entailed. Further, the longer the mains, the more leakage and loss there will be. . . . Further, higher prices may be charged as an inducement to neighbouring areas to seek amalgamation with the local authority which supplies them, in order to secure the benefit of the lower prices charged within the boundaries. Lastly, the trading authority may feel that the outside areas are securing water, gas, or electricity, as the case may be, at lower charges than they could supply themselves, and that it is not unreasonable that they should pay something for the benefit which they thus receive.'[1]

It would frequently appear that one of the motives influencing local authorities in this matter is simply the desire to relieve the rates by making profits at the expense of consumers who cannot effectively express their disapproval via the ballot-box. This, of course, is not an economic justification of the practice. The strongest economic points in its favour would seem to be the two first-mentioned in the above quotation from Professor Knoop; although the first of them seems to call for the comment that the most direct way for the municipality to recoup itself for the risk which it runs, is to charge high prices all round and enjoy the profits, *qua* municipality, in the form of reduced rates. If the risk-taking is recognized by the charging of lower prices in the municipality, it is not the municipality as such, but the gas-consumers within the municipality, who benefit. The difference between the two bodies is greatest where those who consume most gas in the municipality are those who pay least rates.

II. SOCIAL CHARACTERISTICS

(*a*) *Importance to the Community.*

The Napoleon of Notting Hill won a battle by turning off the gas; but if his generalship had been of a more modern order he would probably have preferred to disable and demoralize the civilian population by attacking the reservoirs. For nothing is more necessary to urban life as we know it to-day than a good water-supply. For the community as a whole it is therefore important (i) that interruptions of the water-supply should be guarded against. This is also true to a somewhat lesser degree of the gas, electricity, and tramway industries, and has no direct bearing on prices. Indirectly it affects prices by providing a motive for not leaving the supply of water to individualistic enterprise. But it is important (ii) that the prices charged for water should not be so high as to restrict or altogether prevent its use where considerations of cleanliness and health demand it. This again is an argument against uncontrolled private enterprise. 'In this case, still more in that of gas, it is important for the health of the people that the supply should be in the hands of a body which can have no motive for restricting it; which does not seek profit from it; which can enforce rules for preventing waste, and which can draw upon other funds, if the expense of supply is large.'[1] These facts are also, *per se*, an argument against relating prices accurately to costs (assuming an equal division of overhead costs). For, owing to the part played by customer costs, it is in those smaller households that are least likely to be able to afford high prices that the attributable cost is likely to be greatest per unit of commodity.

---

[1] Knoop, op. cit., pp. 181-2.

(*b*) *Consumption by the Community.*

Much of the water-supply of a city is consumed communally, i.e. through the medium of the local government authority and not separately in individual households. A comparatively unimportant part of this communal consumption is in the local authority's buildings and offices. The more important part is used in public baths, for fountains and ornamental waters, and for watering roads. It is sometimes difficult to say whether the public authority should be charged the same prices as any other large consumer for these supplies of water. Few would argue in favour of charging higher prices, although this is done occasionally through ignorance of the true cost of the supply.[2] Many arguments have been advanced in favour of granting special discounts to public authorities. Some of these are admittedly based upon a deliberate desire to discriminate in favour of communal consumption. Where it is desired to avoid discrimination, the present state of public opinion would still seem to allow differentiation on account of demonstrable differences in conditions of supply, such as might arise from economies of bulk supply, or of predictable or guaranteed consumption, or of consumption at convenient times and in a convenient manner. If the public authority pays less for its supply than such differences would justify, either (*a*) some other consumers will have to pay more than they otherwise would, or (*b*) the undertaking will incur a loss which (in the case of a publicly operated undertaking) will have to be borne by the ratepayers. As it is in any case the ratepayers who pay when the local authority buys anything, it seems to be of little importance whether water supplied by a publicly operated undertaking for public purposes is charged at the usual rate or at a lower rate or even supplied free of charge so long as other consumers do not suffer for this. But where the difference is made up by consumers who are not necessarily ratepayers at all, and who in any case probably do not proportion their expenditure on water to their rates, the point is of great practical importance. For, unless the municipality uses its cheap water solely to benefit these particular consumers, these are helping to pay for something which others are consuming. Whether such a state of affairs is desirable or not is a question of politics and not of economics, and one that therefore lies outside the scope of the present book; but it would be condemned by any general presumption against discrimination as that word is now commonly understood.

---

[1] T. H. Farrer, *The State in its Relation to Trade*, Macmillan, London, 1883, p. 94.

[2] See also Knoop, op. cit., p. 128.

Consideration of the above points demonstrates the impossibility of devising a method of charging that will realize all economic and social ideals. Considerations of cost render the use of meters, at any rate for small consumers, undesirable. Certain social considerations strengthen the objection to them. Considerations of waste, however, render their employment most desirable. The fact that water is easy to standardize and measure facilitates the use of meters. The fact that the domestic consumption of water can be estimated with a fair degree of accuracy makes the use of meters less necessary. Considerations of cost, again, render the charging of differential prices likely, as do also considerations of demand and, as far as seasonal differentiation is concerned, considerations of storage. Social considerations, on the other hand, make social differentiation very undesirable when it operates against the poorer classes of consumer, and even suggest a differentiation in total opposition to the above points. Finally, there are certain matters which involve the question of admitted discrimination. The most interesting of these are that of the prices to be charged for public consumption, and that of the prices to be charged by a public authority supplying to consumers outside its own local government area.

FURTHER READING ON CHAPTER IV

KNOOP, D. *Principles and Methods of Municipal Trading*, Macmillan, London, 1912, pp. xvii and 409.

This has long been the standard English work on municipal trading. It draws on German as well as English experience. Part of the chapter on 'The Selling Policies of Municipal Trades', pp. 180-200, is of particular interest in connexion with the present and next chapters.

CHAPTER V

WATER-SUPPLY: CHARGES

I. CLASSIFICATION OF CUSTOMERS

In the twenty-eight German cities upon a study of whose public utilities this book is based, whereas some waterworks charged all customers according to one fixed tariff, others had two or three tariffs, each applicable to a different class of consumer. The tariffs are not always quoted by the waterworks concerned in the exact form under which they are classified in the following tables. A tariff is properly a scale of charges; but opinions may well differ as to whether a given set of charges constitutes one scale or more. In this and the following chapters, those charges that automatically apply to the consumption of all customers in a given group are regarded as constituting one tariff.

The grouping of customers for tariff purposes in the twenty-eight cities may be seen from Table XX.

Some of these customer-classifications are numerically of small importance and may most conveniently be disposed of before the broader issues are dealt with.

(i) Cologne and Dresden supply water for *fire-hydrants* free. Other cities probably make similar concessions, although only the above two state in their printed tariffs that they do so. Cologne makes a small charge to cover certain consumer costs, but charges nothing beyond this, however much water may be taken for bona fide fire-extinguishing purposes. Dresden makes no charge of any description. This policy may be followed partly as a matter of mere convenience; it is obviously undesirable that the disproportionate expense should be incurred of fitting a meter to measure a supply that is so infrequently requisitioned. It may also be dictated by recognition of the fact that water used for extinguishing fires is used in the general interest and falls therefore into the same class as water used for street cleaning or public baths. If this is the motive, the differential treatment is plainly discriminatory even in the narrower sense of this word; but it is a sort of discrimination with which nobody is likely to quarrel.

(ii) A few towns supply unfiltered *river water* through separate mains for horticultural and industrial purposes. This is charged for at a cheaper rate than the drinking-water supply, in Hanover at a

TABLE XX

Customer-groups for Water Tariffs.

City	Number of Tariffs	TARIFF GROUPS							
		Ord.	*Dom.*	*Ind.*	*Out.*	*Pub.*	*Fire*	*R.W.*	*Other*
Berlin	1	F	—	—	—	—	—	—	—
Hamburg	1	F	—	—	—	—	—	—	—
Cologne	2	SmR+X	—	—	—	—	R	—	—
Munich	2	FR	—	—	FR	—	—	—	—
Leipzig	1	FR	—	—	—	—	—	—	—
Dresden	3	S	—	—	—	F	Free	—	—
Breslau	1	F	—	—	—	—	—	—	—
Frankfort	2	S+B+X	—	—	—	—	—	R	—
Essen	2	SmR	—	—	—	FR	—	—	—
Dortmund	1	SmR	—	—	—	—	—	—	—
Düsseldorf	3	X	—	—	—	F	—	—	R
Hanover	2	F	—	—	—	—	—	F	—
Nuremberg	2	F	—	—	F	—	—	—	—
Stuttgart	3	F	—	—	F	—	—	—	R
Chemnitz	1	FR	—	—	—	—	—	—	—
Gelsenkirchen	2	BmR	—	—	—	—	—	—	BmR
Bremen	1	FR	—	—	—	—	—	—	—
Magdeburg	1	FR+X	—	—	—	—	—	—	—
Königsberg	1	F	—	—	—	—	—	—	—
Duisburg	1	S	—	—	—	—	—	—	—
Stettin	1	S	—	—	—	—	—	—	—
Mannheim	1	BmR	—	—	—	—	—	—	—
Altona	3	—	F	IR	—	—	—	—	X
Bochum	1	F+X	—	—	—	—	—	—	—
Kiel	2	—	F	F+X	—	—	—	—	—
Halle	1	F	—	—	—	—	—	—	—
Barmen	2	—	F	F+X	—	—	—	—	—
Elberfeld	1	F	—	—	—	—	—	—	—
TOTAL TARIFFS	45	25	3	3	3	3	2	2	4

Key to Table XX:

B	Block tariff	*Ord.*	Ordinary
F	Flat-rate tariff	*Dom.*	Domestic
Free	No charge at all	*Ind.*	Industrial
m	With minimum charge	*Out.*	To outside users
S	Step tariff	*Pub.*	For public consumption
X	Special contracts	*Fire.*	For fire-hydrants
I	Improved step tariff	*R.W.*	For river water
R	Meter rent, standing charge, or fixed charge.		

Where two letters or groups of letters are joined by a + sign, the tariff is a compound one, combined from the types of tariff indicated by the letters.

little over half the usual rate, and in Frankfort by a single fixed annual payment which works out normally also at a low average price. Such tariffs, however, are rather tariffs of different commodities than different tariffs for the same commodity.

(iii) Dresden and Essen charge less for water for *public purposes* than for supplies to private customers. Düsseldorf makes a similar reduction, but only for supplies to the public baths. The probable reasons for such differentiation have been referred to on p. 86.

(iv) The water undertakings in Munich, Nuremberg, and Stuttgart charge more to consumers *outside the city boundaries* than to those inside, in accordance with the principles discussed on pp. 84–5, above. The smallest distinction is made by Munich, which charges outside consumers 18 pf. per cubic metre as against 14 pf. for inside consumers, with the same meter rents. The largest distinction is made by Nuremberg, which charges outside consumers 24 pf., and inside 12 pf. per cubic metre. Some of these prices, at least, appear to be discriminatory in the narrow sense.

(v) Three other minor types of customer classification are dealt with in the last column of Table XX. Düsseldorf and Stuttgart charge an annual lump sum irrespective of actual consumption in certain cases where a meter is not installed, either because the amounts taken are very small or because meters are temporarily not available. There is no real division of customers into groups here, as there is for instance in the case of the industrial tariffs. Nevertheless, since consumers have not the option whether they will be charged by this or the ordinary tariff, the two schemes of charging are essentially two separate tariffs. The annual consumption in these cases is estimated according to the principles discussed on pp. 82–3.

Altona charges special prices 'in very special circumstances'. If these special circumstances are nothing more than very large consumption, this does not constitute a separate tariff, but is merely the upper step of an ordinary discount tariff. If they include, as seems likely, such demand factors as freedom from fluctuation, or fluctuation only in accordance with guaranteed schedules, or willingness temporarily to restrict demand on request, the 'very special circumstances' do make a separate group of consumers. Such circumstances are, however, more commonly taken into account in gas and electricity tariffs than in connexion with water-supply, where the problem of 'peaks' is not very urgent.

Perhaps the most interesting of these minor groups of customers is that recognized by the second Gelsenkirchen tariff,[1] which favours small house-owners. But even in this case the existence of consumer costs is allowed for to some extent by the provision that at least 60 cubic metres per quarter shall be paid for, whether consumed or not. It is instructive to compare this tariff with the Vienna domestic tariff,[2] comparing the probable effects of each upon the use of water for purposes for which some people might not be able to pay under more usual price systems.

Having completed a survey of those customer-classifications which are important not numerically but merely as indicating possible lines of experiment in differentiation, we may turn to the only division between customers which is of great intrinsic significance in the theory of water prices in Germany. This is the division between domestic and industrial consumers. Special prices for industrial consumers are quoted in Altona and Kiel, and also in Vienna.[3]

---

[1] Gelsenkirchen Second Domestic Tariff: For owners of single-story houses, who own one house only and are resident in the city,

First 60 cub. m. per quarter . . .	7 pf. per cub. m.
Further consumption	8 pf. per cub. m.

Meter rents, 1 to 2 marks per quarter. The first 60 cub. m. per quarter must be paid for, whether consumed or not.

[2] Vienna Domestic Tariff: For all domestic consumers: 35 litres per head per day free; additional consumption 30 Groschen per cub. m.

[3] Table of Domestic and Industrial Tariffs in Vienna, Altona, and Kiel:

City	*Domestic tariff*	*Industrial tariff*
Vienna	35 litres per head per day free. Further consumption 30 Groschen per cub. m.	12 Groschen per cub. m.
Altona	25 pf. per cub. m.	*Monthly consumption* — *Price per cub. m.* Up to 300 cub. m. — 22 pf. „ 600 „ — 20 „ „ 1,000 „ — 19 „ „ 2,000 „ — 18 „ „ 3,500 „ — 17 „ „ 5,000 „ — 16 „ Over 5,000 „ — 15 „ But the total monthly charge must always be at least equal to the highest possible charge at the rate of the preceding 'step'. In addition, a monthly standing charge of 2-15 marks according to size of meter.
Kiel	30 pf. per cub. m.	23 pf. per cub. m.

As a matter of fact, most industrial consumers receive discounts in many other cities also, but in such cases they receive the discounts as large consumers, not as industrial consumers, and domestic consumers would receive the same discounts if their consumption were up to the industrial level. In Altona, Kiel, and Vienna, however, no domestic consumer, however great his consumption, can claim the discounts that are granted to industrial consumers. Undoubtedly this distinction is made chiefly because industry has normally a much higher demand than the domestic demand, and can therefore be supplied at a lower cost per gallon. But this need not be the sole explanation of the difference in tariffs; greater constancy of demand, or greater predictability, or any other circumstance that makes industrial supply cheaper than domestic, may be responsible for the difference. Or the difference may be due merely to differences in conditions of demand; for whereas the domestic demand for water is, within limits, extremely inelastic, the industrial demand, especially of large firms, may be very elastic, owing to the possibility of self-supply from artesian wells or other sources. Whether price differentiation which is due to this cause is reckoned discriminatory or not will depend largely upon the extent to which, in public opinion, domestic water-supplies and industrial water-supplies are different commodities.

It is interesting to note the means adopted in Vienna to ensure that the poorest domestic consumers shall not be handicapped by the relative dearness of supplies for domestic purposes. This expedient is obviously adopted on purely social grounds, since it ignores the part played by customer costs. The general effect is that the poorest domestic consumers have their water-supply subsidized by the wealthier domestic consumers, and perhaps by industrial consumers; a state of affairs which is evidently maintained for social reasons.

II. TARIFFS

As Table XX shows, forty-five tariffs were in use in the twenty-eight water undertakings in the cities studied. These tariffs may first be classified as either one-part or two-part tariffs,[1] one-part tariffs being those in which the total price paid is calculated on a single basis and varies with the quantity of water consumed, and two-part tariffs those in which an additional 'standing charge'[1] is made, independent of the quantity of water consumed, but related to some other factor. In addition to these two principal types of tariff, the 'fixed-charge' or 'lump-sum' tariff[2] must be recognized. This may be regarded as an extreme form of the two-part tariff in which the quantity-price is reduced to nil, just as the ordinary one-part tariff may be regarded as the other extreme in which the periodical fixed or standing charge is reduced to nil.

---

[1] *Grundgebührentarife* in the official terminology of the Deutscher Verein von Gas- und Wasserfachmännern.

One-part tariffs may be further classified as either (i) flat-rate tariffs[3] or (ii) discount tariffs.[4] A flat-rate tariff is one in which the price per unit remains fixed, whatever the number of units consumed. A discount tariff is one in which the average price per unit decreases as the number of units consumed increases. Two-part tariffs may be similarly classified into two groups according as their first element is a flat rate or a discount scale.

The above classification deals with the essential nature of the tariffs, not with the accidental form in which they are published by the undertakings. An undertaking which announces a flat rate of 14 pf. per cubic metre and the possibility of special contracts with large consumers is really announcing a single discount tariff, so long as all large consumers are charged equal prices for equal quantities.

The table on p. 94 shows the extent to which the various types of tariff are employed in the twenty-eight towns under special consideration.

(i) The most popular tariff is the flat rate, which is employed for nine ordinary and for eight subsidiary tariffs. A good example is provided by the Elberfeld tariff which expressly states that the price is 22 pf. per cubic metre, '*ohne Rücksicht auf die Höhe der Entnahme*'. The chief argument in favour of the flat rate is its simplicity. It involves less book-keeping than any other tariff, and

---

[1] *Grundgebühr*, ibid.

[2] *Pauschaltarif*, ibid.

[3] This is the usual English term for what Germans call the *Einheitstarif* and Americans the uniform meter rate or straight-line tariff. By 'flat-rate tariff' Americans generally understand what I have called the fixed-charge tariff and the Germans call the *Pauschaltarif*.

[4] *Stufentarif*, D.V.G.W.F.

TABLE XXI

Types of Water Tariff

Type of Tariff	*Group of customers to which applicable*								
	Ord.	*Dom.*	*Ind.*	*Out.*	*Pub.*	*Fire*	*R.W.*	*Other*	*All*
One-part:	*14*	*3*	*2*	*2*	*2*	—	*1*	*1*	*25*
Flat rate	9	3	—	2	2	—	1	—	17
Discount:	*5*	—	*2*	—	—	—	—	*1*	*8*
Step	3	—	—	—	—	—	—	—	3
Block	—	—	—	—	—	—	—	—	0
Compound	2	—	2	—	—	—	—	1*	5
Two-part:	*11*	—	*1*	*1*	*1*	—	—	*1*	*15*
Flat rate	4	—	—	1	1	—	—	—	6
Discount:	*7*	—	*1*	—	—	—	—	*1*	*9*
Step	2	—	1	—	—	—	—	—	3
Block	2	—	—	—	—	—	—	1	3
Compound	3	—	—	—	—	—	—	—	3
Fixed charge	—	—	—	—	—	1	1	2	4
Free	—	—	—	—	—	1	—	—	1
Total	25	3	3	3	3	2	2	4	45

* Altona special tariff for 'very special circumstances'.

seems to the average customer the fairest and most natural method of charging. The chief objection to it is that it ignores customer costs and thus discriminates against large consumers, and incidentally provides the small consumer with no special incentive to increase his consumption. This discrimination is sometimes deliberately done from social motives, and sometimes tolerated as a lesser evil than complicated book-keeping. The latter reason is likely to be of great weight only in small villages where there are no very large consumers and where the differences in cost that could be allowed for in a more complex tariff are so small as not to be worth troubling about. In the twelve cities employing the flat rate for their ordinary or domestic tariffs the motive for the differentiation against large consumers is probably social, except in Altona, Kiel, and Barmen, where most large consumers receive favourable rates *qua* industrial consumers. It must also be borne in mind that other water undertakings may give unpublished rebates to large consumers, thus in effect turning their tariffs into discount tariffs, the type discussed next.

(ii) A discount tariff has been defined as one in which the average price per unit decreases as the number of units consumed increases. The obvious design of such a tariff is to give recognition to the well-known fact that 'it is cheaper to supply in large quantities', i.e. to take customer costs as well as prime costs into account. One way of doing this is to give a discount off the unit or the total price to all consumers whose periodical consumption exceeds a certain amount. This is the simplest form of the discount tariff, and one that provides a fair approximation to cost conditions only when the consumers are divisible into two distinct groups, such that the average consumption in one group differs considerably from that in the other, and such that the individual consumption within either group is never very much greater or less than the average consumption in that group. Such conditions are rarely met with, especially in large cities, but they may be roughly approximated to where domestic and industrial consumers form two fairly distinct groups.

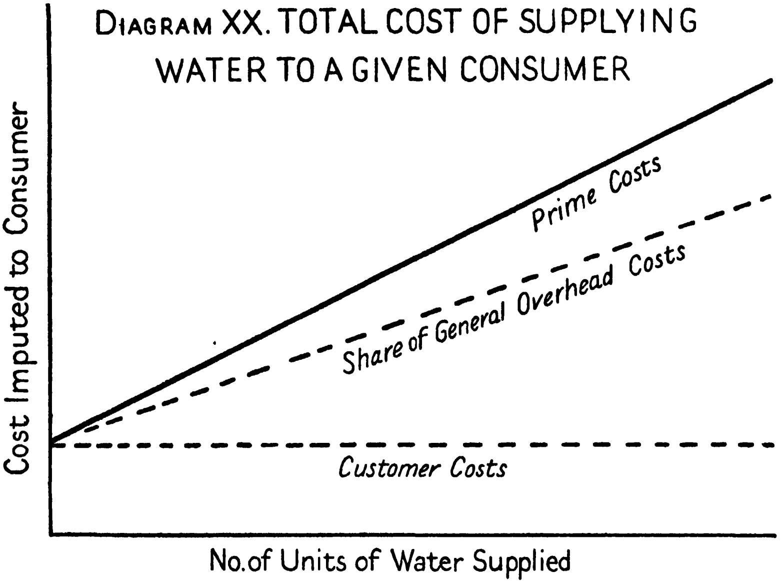


DIAGRAM XX. TOTAL COST OF SUPPLYING WATER TO A GIVEN CONSUMER
Cost Imputed to Consumer
Prime Costs
Share of General Overhead Costs
Customer Costs
No. of Units of Water Supplied

The total cost of supplying different quantities of water to a consumer (general overhead costs being divided equally among equal quantities of water) may be represented in a simplified form by the diagram above.

An alternative arrangement divides general overhead costs so as to favour large consumers.

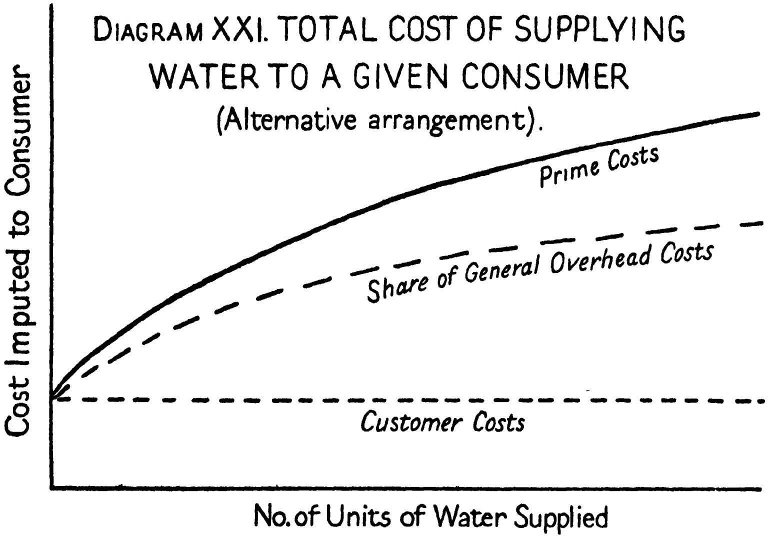


DIAGRAM XXI. TOTAL COST OF SUPPLYING WATER TO A GIVEN CONSUMER (Alternative arrangement).

Taking either diagram as a basis, we may calculate the *average* cost per unit of the water supplied to a consumer and represent it as in Diagram XXII by the curve *CC′*.

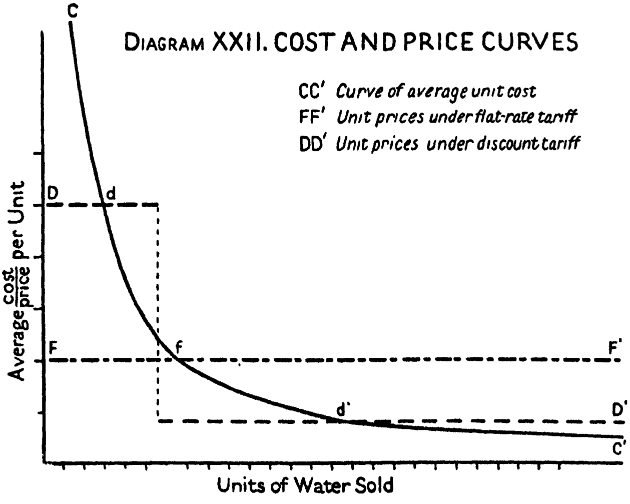


DIAGRAM XXII. COST AND PRICE CURVES

On such a diagram the average price per unit under a flat-rate tariff would be represented by a horizontal straight line, such as *FF′*; and the average price per unit under a discount tariff with one 'step' in it by such a line as *DD′*. It will be seen that under either tariff the over-charging of some consumers and the under-charging of others is inevitable, unless the amounts actually consumed all lie at certain favourable points on the curve—the point *f* for the flat-rate tariff and the points *d* and *d′* for the discount tariff.

The number of points at which the line *DD′* can cut the line *CC′* obviously depends upon the number of 'steps' in the former.

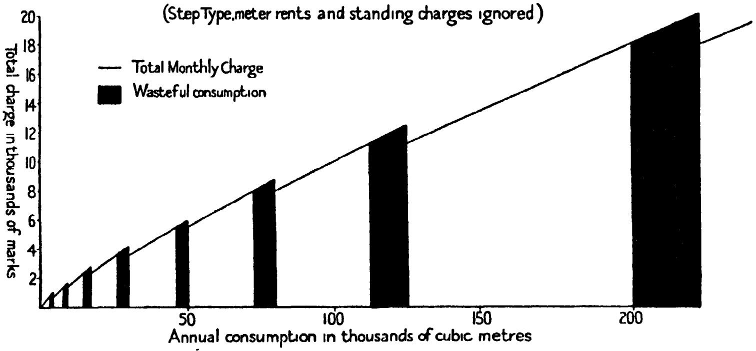


DIAGRAM XXIII. WATER TARIFF
(Step Type, meter rents and standing charges ignored)

That is to say, closer and closer approximation of prices to costs can be made by increasing the number of 'steps' in the discount scale. The Stettin waterworks charges according to a tariff with three steps. Its prices are:

Where the annual consumption does not exceed 12,000 cub. m. . . .	25 pf. per cub. m.
Where the annual consumption exceeds 12,000 cub. m. but does not exceed 24,000 cub. m.	10 per cent. discount.
Where the annual consumption exceeds 24,000 cub. m.	20 per cent. discount.

Some of the discount schedules contain as many as nine steps; this being of course the result of an attempt to bring the price 'staircase' into close relationship with the cost curve. From such schedules as that of the tariff reproduced in Diagram XXIII above, it is easy to reconstruct the cost curve upon which the tariff may be based and to note the possibility of reasonably close relationship between cost and price.

It will be seen from Table XX that the pure 'step' tariff[1] as described above is in use in three undertakings only of the twenty-eight dealt with, viz. those in Dresden, Duisburg, and Stettin. None of these undertakings uses any additional tariffs in its dealings with ordinary private consumers, and it must therefore be assumed that all have found the simple step tariff a satisfactory expression of variations in cost over the whole range of demand. (Dresden supplies the public authorities and fire-hydrants on special terms, but the reason for this is not closely connected with cost-variations.) The Dresden tariff has six steps, the Duisburg and Stettin three each. In every case the first step goes well beyond the probable limits of domestic consumption.

In general the step tariff is not very popular, for two principal reasons. In the first place, if the steps are large the degree of relationship between prices and costs is apt to be small; and if the steps are small, their existence is likely to lead to administrative and accounting complications. And in the second place, the step tariff tends to encourage deliberate waste, since at certain points of the scale (i.e. towards the edges of the 'steps') a slight increase in total demand means a *decrease* in the total price. Under the Dresden tariff, for example, a consumer of 4,960 cubic metres per annum pays the standard price of 25 pf. per cubic metre, i.e. he pays 1,240 marks altogether. A consumer of more than 5,000 cubic metres receives a discount of 2 per cent., however. If, therefore, the above consumer deliberately wastes an extra 80 cubic metres, thus bringing his total consumption up to 5,040 cubic metres, he pays only 98 per cent. of 5,040×25 pf. = 1,234·80 marks altogether. By wasting 80 cubic metres he thus saves the price of more than 20 cubic metres. Such saving by wasting may occur at the edge of any step in a step tariff; and therefore where such a tariff with many steps is in use a large number of consumers are likely to find themselves with an inducement to waste.

Sometimes this second objection is overcome by the stipulation that the minimum total charge in any step must be equal to the maximum possible total charge in the previous step. This provision is inserted in the Altona industrial tariff.[2] If it had been inserted in the Dresden tariff, the effect would have been that no consumer belonging to the 5,001–10,000 cubic metre step would have had a smaller bill than that of the largest possible consumer in the 0–5,000 cubic metre step. Now the highest possible charge in this step is 5,000×25 pf. = 1,250 marks. All consumers of any quantity from 5,000 to 5,101 cubic metres would therefore pay the same total price. The chief weakness of this device is that although it does not positively encourage a consumer to waste, neither does it positively discourage him from wasting, since he may still have certain supplies the consumption of which costs him nothing. The 'block'[1] method is therefore to be preferred.

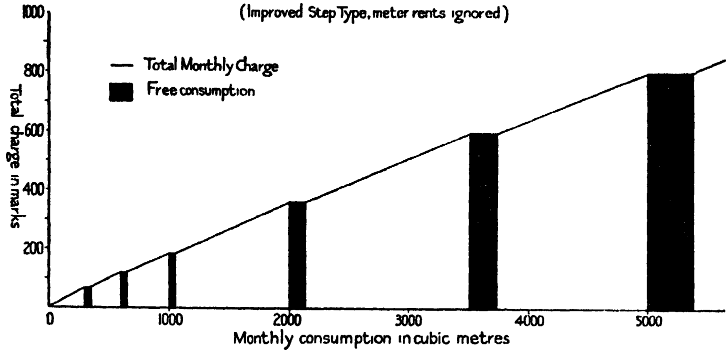
---

[1] *Staffeltarif*, D.V.G.W.F.

[2] See Diagram XXIV.

DIAGRAM XXIV. WATER TARIFF

(Improved Step Type, meter rents ignored)



In a block tariff the successive reductions in price apply, not to the total consumption, but only to the additional consumption. In Mannheim, for instance, the first 10,000 cubic metres consumed annually cost 18 pf. per cubic metre; additional supplies up to a further limit of 20,000 cubic metres cost 16 pf. per cubic metre; the next 20,000 cubic metres cost 14 pf. per cubic metre; the next 50,000 12 pf. per cubic metre; and any further consumption 10 pf. per cubic metre. Such a tariff gives no free supplies and thus discourages waste throughout the whole range of demand. The chief objection to it is that it complicates book-keeping even more than the step tariff does, and that it is liable to be regarded with a certain amount of mistrust by consumers.

The block tariff does not appear among the one-part tariffs in Table XX, although it is present in a disguised form in the Vienna domestic tariff, which gives a free allowance of 35 litres per head per day and charges for the rest at 30 groschen per cubic metre. But the motive in this case is just the opposite of that which usually dictates the employment of block tariffs. It is usual to make the price of the first block higher than that of the second, and so on, in order to allow for consumer costs. Vienna, however, reverses this order, as also does Gelsenkirchen in its special domestic tariff, and differentiates on social grounds in favour of the small consumer.

---

[1] *Zonentarif*, D.V.G.W.F.

Two other one-part discount tariffs appear in Table XXI, under the classification 'Compound Tariffs'. These are the Barmen and Kiel industrial tariffs, each of which consists of a flat rate modified by the granting of special discounts to large consumers as such. Whether these are in essence step or block tariffs depends upon the manner in which these discounts are made; and no information is published upon this point.

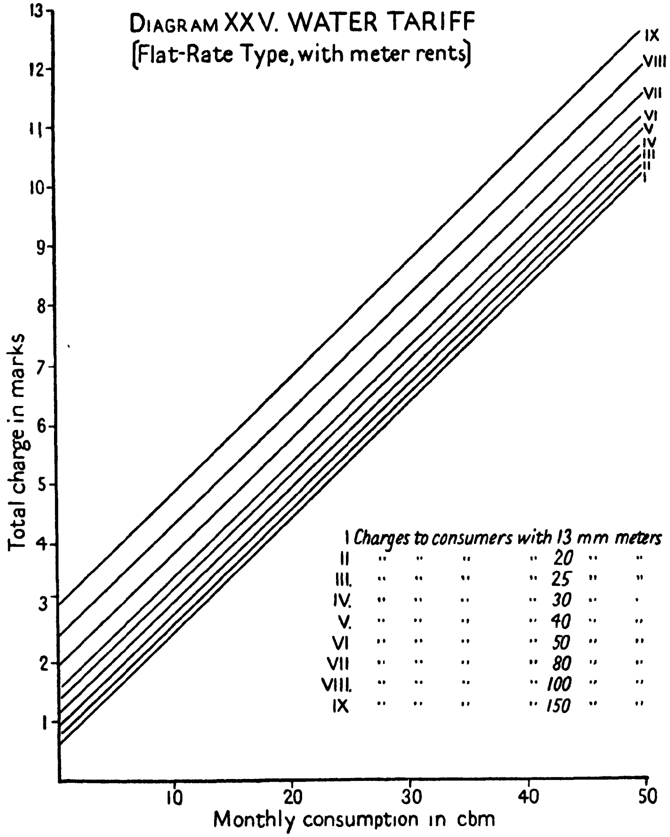
(iii) As has been suggested above, all forms of discount tariff are open to objection, the general objection to them all being that exact relationship between price and cost is not even theoretically possible under them, unless the number of steps or blocks is infinitely large. To meet this objection the two-part tariff was introduced, the chief merit of the two-part tariff being its *direct* recognition of consumer costs, as opposed to the indirect recognition given them by discount tariffs. Any charge under a two-part tariff consists of two elements, one of which varies with consumption and is intended to account for prime costs and a share of the general overhead costs, and another of which varies independently of consumption and is intended to account for consumer costs. Thus in Düsseldorf water costs 19 pf. per cubic metre to all except the very large consumers, but in addition a monthly standing charge has to be paid.[1] The standing charge varies in amount, according to the size of the meter employed, from 70 pf. to 3 marks per month. Since the size of the meter is a fair index of the consumer costs, such a tariff permits very accurate adjustment of prices to costs.

Four water undertakings use the above form for their ordinary tariffs, and two use it for subsidiary tariffs. Three undertakings—those in Leipzig, Chemnitz, and Bremen—charge all their customers by a single tariff of this type; and Munich uses two such tariffs—one for customers inside and one for customers outside the city—and no other tariffs. Essen uses such a simple two-part tariff for water for public purposes.

This tariff would probably be much more popular than it is if it did not throw such a heavy burden upon very small consumers. This burden may be merely the expression of the relatively high consumer costs which small supplies involve, and yet it is often regarded as undesirable. This is, as a matter of fact, one case in which the general opinion that unequal distribution of overhead costs is discriminatory does not appear to be held. The difficulty is sometimes overcome to some extent by the compromise of charging small consumers less than their real consumer costs and large consumers more.

---

[1] See Diagram XXV.

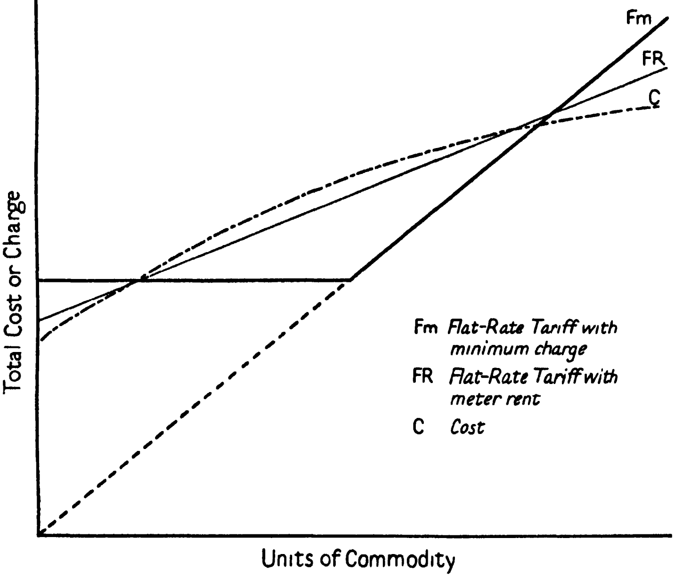


(iv) The two-part tariff is frequently based upon a discount scale of one type or another, instead of upon a flat rate as in the above examples. Three of the forty-five tariffs are thus based upon a step scale, three more upon a block scale, and three more upon a compound discount scale. The object in each of these cases seems to be either (i) to distribute the charge on account of consumer costs between the standing and the unit charges; or (ii) to distribute the general overhead costs unequally, in favour of large-scale consumers. The second object is probably the more frequent, although it leads to what is usually reckoned discriminatory charging. But such differentiation in favour of large customers, leaving the question of traceable customer costs out of account, is often approved by public opinion on some such vague grounds as that 'large customers are more profitable' or 'large customers deserve special consideration'—slogans which, apart from the matter of customer costs, are simply not true. Some such reasons suffice to render public opinion fairly favourable to such a distribution of general overhead costs, however,—a method of charging to which the name 'discrimination' may or may not be appropriate—and thus the way is left open for undertakings to adopt it if they wish. They usually do wish to do so, because the capacity of large consumers of water to bear heavy charges is usually smaller than that of small consumers, the reason for this being the power which large consumers often have of supplying themselves from other sources.

Some of these tariffs are further complicated by clauses which provide for the payment of certain minimum sums, apart from the 'standing charges', whether the consumption to which they correspond has actually occurred or not. Thus in Gelsenkirchen, under the general tariff, quarterly charges of from 1 to 2 marks must be paid, whether any water is consumed or not. The actual consumption is then charged for under a block tariff—10 pf. per cubic metre for the first 60 cubic metres per quarter, 8 pf. per cubic metre for further consumption. But the first 60 cubic metres must be paid for, whether consumed or not. It is a little strange to find such a provision as this included in a set of tariffs which seeks to grant special favours to small consumers, although the motive may conceivably be a desire to discourage too great economy in consumption. In general, however, while the minimum charge clause might be accepted as a means of covering consumer costs—although the superiority of 'standing charges' for this purpose is incontestable (see Diagram XXVI)—it is very difficult to find good reasons for employing both devices together. If a minimum charge clause is to be inserted in a tariff, one of the Mannheim type—i.e. one in which the minimum varies with the value of the property served or the size of the meter or some such index—is less open to objection on both social and economic grounds than one in which the minimum is the same for all consumers. It is at the same time more open to criticism as being more complicated.

It remains to say a word about the standing-charge element in two-part tariffs. The standing charge is usually called a 'meter rent', although it is as a matter of fact often much larger than the interest and depreciation charges on a water-meter would amount to. Its economic aim is, as has been pointed out, the covering of consumer costs, although this aim may be modified by conflict with social aims. The standing charge in its simplest form should therefore be greater for large installations than for small ones, and such a result may usually be secured by making the charge take the form of a rent which varies with the size of the meter. In Leipzig, Dortmund, Mannheim, Munich, Essen, Düsseldorf, Gelsenkirchen, and Altona the rent varies with the size of the meter inlet, and in Bremen and Cologne with the capacity of the meter during a given period. Of the remaining two 'meter-rent' tariffs, one[1] bases the

DIAGRAM XXVI. CORRESPONDENCE BETWEEN COSTS AND FLAT-RATE CHARGES



---

[1] The Magdeburg tariff.

charge on the quarterly consumption and the other[1] on the pre-war rateable value of the site of the property served. In the eight cases where the amount of the rent depends on the size of the meter-inlet there is a considerable amount of variation in the prices charged. The amount of the variation is illustrated by Diagram XXVII, which shows that the monthly standing charges

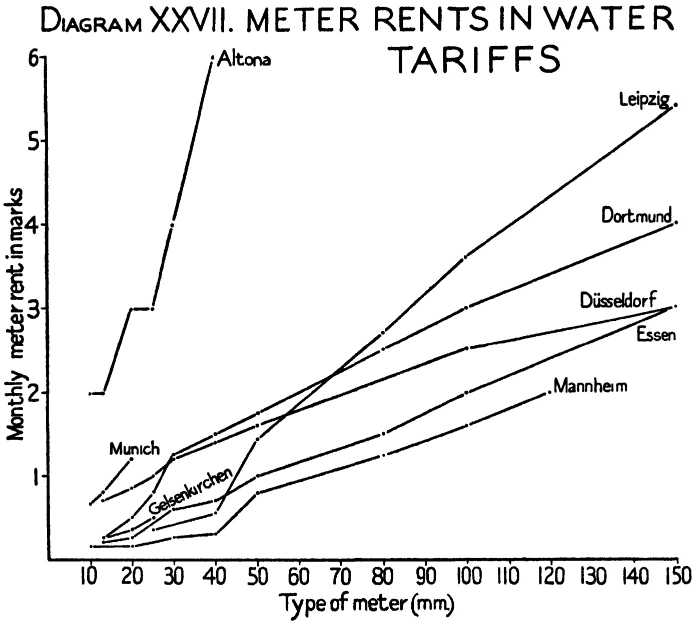


DIAGRAM XXVII. METER RENTS IN WATER TARIFFS

vary from 15 to 70 pf. upwards and are usually closely proportioned to the size of the meter. Leipzig, Mannheim, and Dortmund seem to temper the wind to the small consumer, as will be seen if a straight-edge is laid along the graphs representing their charges. It is interesting to note that there appears to be no significant degree of correlation between the unit price of the water and the standing charge, a relatively high unit price being charged by Altona, Leipzig, Düsseldorf, Essen, and Mannheim, and a relatively low one by Munich, Dortmund, and Gelsenkirchen.

(v) As has already been mentioned, only two cities charge for ordinary supplies by estimate, and then only as a purely subsidiary device to be used in the comparatively few cases where the employment of meters is thought unnecessary.[1] The Cologne practice of charging a fixed rental but no meter-rate for fire hydrants is really an example of this type of tariff, although no attempt is made to adjust this rental to correspond to any quantity of water that is likely to be used. Frankfort also charges by estimate for river water.

---

[1] That of Chemnitz.

The chief economic advantage of this method of charging is that it saves the expense of a meter and certain inspection and book-keeping costs, and the chief social advantage that it permits the direct expression of any subsidy policy that may be desired. The chief objection to it is that it fails to discourage waste. This is so serious a matter that in England, where the method is almost universally used for charging for domestic supplies, and in America, where it is still widely used, special steps have to be taken to minimize the loss from waste. (The London Metropolitan Water Board has stated, for instance, that it finds it cheaper to allow its own workmen to re-washer taps and to pay for any expensive lavatory basins that they may incidentally break than to leave the re-washering to the customer's initiative and run the risk of loss by waste.[2])

---

[1] The principal items in the scales of estimates of consumption are as follows:

(1) Düsseldorf:

Details of establishment	*Estimated annual consumption.* cub. m.
For every room up to a maximum of 10	20
For every additional room	12
For every bath	80
For every W.C.	40
For hot-houses, per superficial square meter	2
For horses and cattle, per head	24
For one fireplug, where no other supplies are taken	48
For additional fireplugs, do.	16
For fireplugs, where an ordinary supply is also taken from the city works	nil
For fountains, according to size of jet	50–400

(2) Stuttgart:

	Estimated quarterly consumption.
For each room	3
For each W.C.	8
For each car of 3-5 h.p.	20
For each car of more than 5 h.p.	30

[2] M.W.B. Annual Report, 1929, p. 51. See also p. 82 of the present work.

In 1912 Professor Knoop commented on the fact that 'the policy of charging by meter for water supplied for domestic purposes appears to be very uncommon amongst the water undertakings managed by the larger British local authorities. Amongst German municipalities, on the other hand, it appears to predominate'.[1] To-day this distinction is even more pronounced, as may be gathered from a glance at Table XXI; and the impression thereby received is strengthened by a survey of a wider field. Of the 770 undertakings whose tariffs are set out in a confidential booklet issued by the Deutscher Verein von Gas- und Wasserfachmännern, 734 meter their domestic supplies, 95 estimate consumption in certain special circumstances, and only 36 rely solely upon the method of estimate for domestic supplies. Of the 95 undertakings which charge by estimate in certain circumstances, two only (Düsseldorf and Stuttgart) are in cities of more than 200,000 inhabitants, two are in cities of between 100,000 and 200,000 inhabitants, and two in cities of between 50,000 and 100,000 inhabitants. Most of the rest are in small villages. And of the 36 undertakings which never meter domestic supplies, none are in cities of 100,000 or more inhabitants, two are in cities of between 50,000 and 100,000 inhabitants, and most of the rest are in small villages.

It is not easy to account for this interesting contrast between the methods of Germany and those of England. Taking into consideration the political tendencies of British and German municipalities, and the social significance of the two methods of charging, one might perhaps have anticipated that the situation would be the reverse of what it is. Charging by estimate might have been more customary in post-war Germany if it had not been for those financial difficulties which have rendered social experiment so difficult. It is also possible that the water-supply industry is regarded by the municipalities as a less fertile field than the gas and electricity industries for such limited experiment as they can afford. The Vienna domestic tariff and, less remarkably, that of Gelsenkirchen are among the few exceptions to what appears to be the general business principles of charging for water in the larger German and Austrian cities.

A certain degree of correlation might be expected to exist between the size of a city, or its consumption of water, and the type of water-tariff in use in it, but the above tables fail to disclose any such correlation as far as the twenty-eight cities under consideration are concerned. On the contrary, there seems to be a rather remarkable degree of independence between the two. An examination of the confidential statistics of the Deutscher Verein von Gas- und Wasserfachmännern fails to reveal any considerable degree of correlation over the whole German water-supply industry, with the exception that both flat-rate tariffs and fixed charge tariffs (i.e. charging by estimate) seem to be commonest where the number of consumers is small.

---

[1] Knoop, op. cit., p. 193.

The ideal tariff would at least fulfil the following four conditions:

1. It would be easy for the consumer to understand.
2. It would be simple for the undertaking to apply.
3. It would be 'economic'—i.e. it would permit the maximum utilization of the capacity of the undertaking, so long as all costs were covered by the units to which they were attributable.
4. It would be 'just'—i.e. it would satisfy public opinion in not being discriminatory except where public opinion wished it to be so.

No tariff has ever been invented that fulfils all of these conditions, for they are to a large extent in mutual opposition. Public opinion on the subject of discrimination is often opposed to the whole-hearted application of the third of the above rules, for example; and a tariff that gave close approximation to traceable costs and distributed the rest in deference to public opinion might be neither easy to understand nor simple to apply. Apart from tradition, the chief force that has actually affected the choice of a scheme of tariffs in the cities studied seems to be the relative stress laid upon social and economic considerations. Where it is desired to give most weight to economic considerations—as is nowadays the case in many German cities where the municipal trading enterprises are relied upon to produce much-needed revenue—the two-part tariff based upon a flat rate, possibly with special discounts for unusually large consumers, seems to be the most convenient type of tariff to adopt. The ordinary discount tariff may be almost as good in some circumstances, especially if it is of the block and not of the step form. The ordinary flat-rate tariff cannot be commended from the purely economic standpoint, except for very small undertakings; and the fixed-charge tariff is very uneconomical, inasmuch as it does not discourage waste; but it is sometimes cheap and convenient despite this drawback. It makes no real pretence to embody rigid economic principles, however.

Almost any tariff may be made a tool for the execution of policies of social amelioration, although their simplicity is likely to commend the rather uneconomic flat-rate and fixed-charge tariffs. Both of these are hardly usable in the industrial field, however—the fixed-charge tariff because of the great elasticity of the industrial demand for water and the large quantities involved and the absence of anything like a standard, and the flat-rate tariff because large consumers are usually in a position to seek alternative sources of supply if they fail to obtain those discounts which both business tradition and strict economic reasoning allow them.

FURTHER READING ON CHAPTER V

The chief sources of information relating to German water charges are the published tariffs of the individual undertakings. A certain amount of information is also given in the *Statistisches Jahrbuch deutscher Städte* published by the Verband deutscher Städtestatistiker.

The Deutscher Verein von Gas- und Wasserfachmännern issues confidential lists of tariffs from time to time, but these are unfortunately not available for general reference purposes. From time to time useful articles dealing with various aspects of water and gas charges appear in the official organ of the Verein, *Das Gas- und Wasserfach*, Oldenburg, Munich, weekly.

KNOOP, D.: *Principles and Methods of Municipal Trading*. (See note on Chap. IV.)

CHAPTER VI

GAS-SUPPLY: CHARACTERISTICS

ALTHOUGH gas-supply undertakings share with water-supply undertakings and other public utilities certain important general characteristics, they also have some peculiarities of which account must be taken in a study of gas tariffs.

I. ECONOMIC CHARACTERISTICS

(*a*) *Nature of Costs.*

The *overhead* costs of gas-supply do not bulk so large as those of water-supply. They consist, firstly, of costs incurred in connexion with the establishment of the undertaking. These are of precisely the same nature and importance as the corresponding costs of water undertakings. They consist, secondly, of costs attributable to the construction and upkeep of the generating plant. These are proportionately a smaller item than are the corresponding costs in water undertakings. Furthermore, gasworks extensions can be adjusted more closely to increases in demand than can extensions of waterworks. A third group of overhead costs is incurred for service pipes, meters, and the like. The costs of such fittings as burners, stoves, and fireplaces are usually borne directly by the consumer and therefore do not constitute part of the costs of the undertaking. Where for any reason the undertaking supplies these fittings without making a special charge for them, their cost forms part of the customer costs. The costs of the administrative side of the business of gas-supply are overhead for larger or smaller batches of product, according to principles similar to those that govern the cost of waterworks operation.

Prime costs are a more important feature of gas than of water undertakings. The principal raw material of the water-supply industry is not purchased in varying quantities as required; that of the gas-supply industry is, and the cost of coal may be almost a prime cost of each cubic foot of gas generated. The costs of other raw materials employed in gas manufacture are also likely to be prime to this extent.

(*b*) *Measurement of the Commodity.*

Gas as a commodity used to be a little more difficult to measure than water. The difficulty did not arise merely from the fact that the volume of gas is much more susceptible than that of water to the varying influences of temperature and pressure, but was also in part a problem of finding a satisfactory standard of quality. In the case of water this problem presents no difficulty, since those standards by which the suitability of water for drinking purposes is determined serve also for the determination of its suitability for all other purposes for which water is usually required, except perhaps in certain industries. The unit of measurement of water thus becomes a certain volume with a certain limited bacterial and chemical content. But gas is required for at least two different purposes and so long as the old type of burner was employed for lighting, that gas which was the best for purposes of illumination was not necessarily the best for heating. This difficulty was removed by the introduction of the incandescent mantle, and heating power has become the standard by which the quality of gas is measured. Nowadays gas is usually sold either by the cubic foot or cubic metre at a given temperature and pressure and of a given calorific value or directly in thermal units. But where it is thermal units that are charged for, these are still not measured directly, but are calculated by multiplying a calorific factor by the volume measured by a metre.

(*c*) *Structure of the Market.*

The demand for gas varies more throughout the day, week, and year than does the demand for water. The industrial demand is, in the absence of special factors such as those introduced by the demands of seasonal industries, likely to be as great at one time of the year as at another; but it will usually fall off heavily during week-ends, and to a lesser degree during the night and at midday.

The domestic demand for lighting, which every year exercises a smaller influence on the shape of the general load-curve, is of course heavier in the winter than in the summer, is distributed fairly evenly over the days of the week, and is distributed very unevenly over the hours of the day, being practically restricted to a few evening hours for half of the year, and to a larger number of evening hours and a small number of morning hours during the other half.

The domestic demand for heating is usually highest in the spring and autumn and lowest in the summer. The reason for this is the supplementary nature of much gas heating. During the winter in many houses a regular system of heating by coal or coke is employed, and the use of gas for this purpose is unnecessary. During the summer very little heating is required at all. But during the spring and autumn, the regular heating system is often not in use and gas-heating is employed on cold days and especially during the mornings and evenings. In districts where gas heating is more than usually popular, the winter use of it may be greater than the spring or autumn use; but this is not usually the case. The domestic demand for heating is fairly constant throughout the week, but usually reaches a daily maximum at some time in the morning or evening. In normal circumstances the domestic cooking demand for gas is greatest during the summer; but where nothing but gas is used for cooking all the year round the winter demand is naturally heavier than the summer demand. The weekly cooking demand has, especially in Germany, a tendency to reach a maximum on a particular day of the week, usually Saturday or Sunday. The daily demand curve for cooking has peaks which occur shortly before meal-times, especially the midday and evening meal-times. Various subsidiary domestic demands, such as that for heating water for household or bathing purposes, also follow certain fairly fixed curves, thanks to the regular customs and habits of most households; but these are, even collectively, not very important and have a small influence over the shape of the total load-curve of the undertaking.

The shape of this general curve is of course determined by the shape of its component curves, which are usually those mentioned above together with some less important ones derived from the demand for gas for street lighting, the heating of shops and offices, and the like. In most of the twenty-eight undertakings whose tariffs are specially dealt with in the present work, the chief determinants of the total load-curve are the industrial demand and the domestic demands for heating and cooking.

These variations give a certain amount of scope—greater than in the water industry but still much less than in the electricity and tramway industries—for differentiation of prices based on time of consumption. But most of the differentiation in the gas industry is based on the nature of the consumption, the feasibility of this policy depending on the degree of polypolistic or monopoly power which technology and law bestow on most undertakings. The

DIAGRAM XXVIII. DAILY LOAD-CURVE OF TYPICAL GAS UNDERTAKING

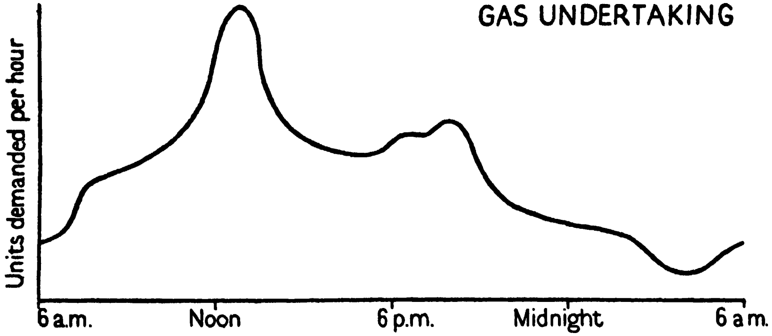


DIAGRAM XXIX. WEEKLY LOAD-CURVE OF TYPICAL GAS UNDERTAKING

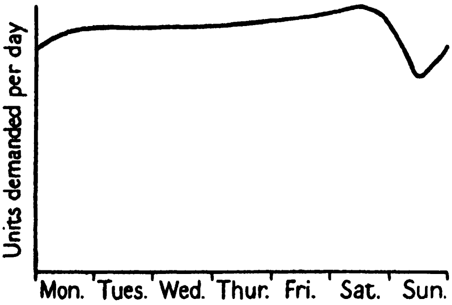
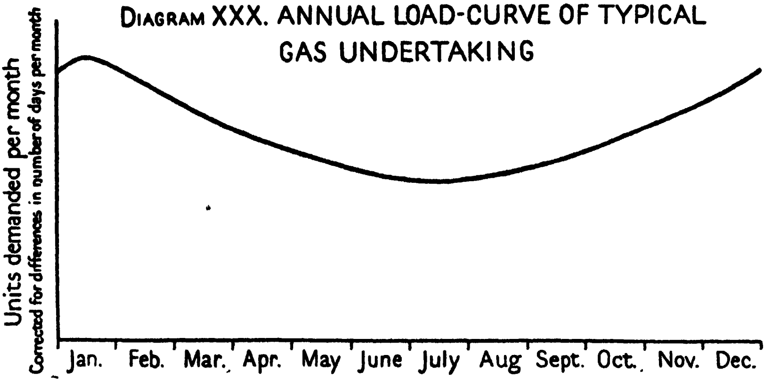


DIAGRAM XXX. ANNUAL LOAD-CURVE OF TYPICAL GAS UNDERTAKING



degree of power over the market is almost the same as in the water-supply industry; but the possibilities of distinguishing between uses are greater. This fact, which is commented on more fully in the latter part of this section, depends very largely on the circumstance that gas can ordinarily be consumed only in various special sorts of apparatus, which usually being fixtures make a convenient basis for classification of consumption.

The principal demands for gas, as for water, are the domestic and the industrial; but unlike the demands for water, those for gas are very elastic. This is due chiefly to the competition of substitutes for gas. The domestic demand is composed of three elements—the demands for lighting, cooking, and heating respectively. In the early years of the gas industry the domestic demand was solely for lighting, but electricity has so successfully invaded this field that many gasworks have ceased to contest it,[1] and have concentrated their attention on supply for cooking and heating.

The extent of the competition of electricity cannot be judged merely from a comparison of prices. The difference of convenience and general effectiveness of the different sources of illumination also influences the customer's choice between them. 'Electric lighting does not vitiate or use up the air, it hardly affects the temperature of the rooms in which it is used, it is essentially clean and does not blacken ceilings, wall-papers, &c. The way in which it can be switched on and off is extremely convenient, it lends itself excellently for decorative purposes, and it can be brought close to inflammable materials without danger.'[2] It is a mistake to assume that all the advantages are on the side of electricity—'there are many people to-day who continue to use gas-lighting, not because they cannot get electricity but because they prefer the pleasant warmth and soothing light of gas'[1]—but there can be no doubt that for most purposes of illumination electricity is nowadays widely preferred to gas, even where it is more expensive.

---

[1] Gas is, however, not yet completely *hors de combat* in the field of lighting. Cp., for instance, the following remarks made by chairmen at recent gas-company meetings: 'In some quarters there is an impression that gas lighting has ceased to exist. We, of course, know that this is not so, and when I tell you that during the year we sold to our slot-meter consumers alone over 44,000 complete sets of incandescent burners, mantles, and globes you will realize that gas-lighting is still a "live" proposition.' (Commercial Gas Company, reported in *The Times* newspaper, Feb. 13th, 1931.) 'It is to them only [certain officials] that the credit is due for the magnificent examples of scientific street-lighting which may now be seen on some of the main thoroughfares in South London. Unfortunately, it happens that not infrequently these are believed to be electric and not gas lights by passing motorists or pedestrians, who do not realize the greater penetrative and diffusive power of the older illuminant when the latest types of lamps are used.' (South Metropolitan Gas Company, reported in *The Times* newspaper, Feb. 5th, 1931.)

[2] Knoop, *Municipal Trading*, p. 205.

In the fields of cooking and heating the competition of electricity will probably remain a comparatively negligible factor unless and until a completely new and much more efficient type of heating element is invented. So long as only the present type is available, there seems to be a great deal to be said for such views as the following, recently expressed by the director of a large German gas undertaking: 'For more than twenty years, since I first entered the gas business, I have always urged the point of view that generally speaking the generation of heat is the task of gas, not of electricity. . . . The provision of domestic heating by means of electricity on a large scale is for the present and for the imaginable future an absolutely uneconomic enterprise.'[2]

But this does not means that gas is without competition in these fields. It has to meet the very severe competition of oil and solid fuels. Often these fuels are cheaper than gas, although gas is still preferred on account of certain special advantages which it possesses, just as electricity is sometimes preferred to gas for lighting purposes. 'Among these are the well-known properties of gas: its cleanliness, its quick and constant readiness, the way in which it lends itself to easy and exact regulation, the small demands it makes upon space, time, and labour, and the general convenience of its use. These imponderables may together be called the "convenience factor". This convenience factor will also be valued differently by the consumer, according to the particular circumstances. Thus, in the household the convenience factor is especially highly valued. In business and industry—although even here the readiness and ease of regulation of gas are very highly valued—the convenience factor is of less importance, since here it is above all the directly calculable values that are decisive.'[3]

The demand for gas for uses which involve the installation of special and often expensive apparatus, such as geysers or refrigerators, is very elastic indeed over the whole body of consumers, but may be very inelastic among those consumers who have taken the initial step of having the necessary apparatus installed.

---

[1] South Metropolitan Gas Company, loc. cit.

[2] Herr Elvers, 'Der Stand der Gastariffrage', *Das Gas- und Wasserfach*, Sept. 7th, 1929, p. 881.

[3] Dr. Strölin, 'Gaspreis und Gastarifbildung', *Das Gas- und Wasserfach*, April 7th, 1928, p. 328.

The industrial demand is chiefly for power. Although conditions vary greatly from industry to industry, this demand is in general also very elastic, owing to the competition of various kinds of fuel on the one hand and of electricity on the other.

Where the demand for a commodity is very elastic there is a strong argument against unmetered supplies. Nevertheless, the domestic demand for gas differs from that of water in that it can only become effective through the medium of various sorts of apparatus. The control of the installation may therefore be almost as effective a check upon demand in some cases as the direct control of consumption would be. The effectiveness of this check is naturally greatest when it is applied through those kinds of apparatus in which consumption can proceed only at a fixed rate and is either continuous or confined to fixed periods. Refrigerators, street lamps, and heating apparatus in public buildings, fulfil these conditions more or less perfectly, and it is therefore sometimes considered unnecessary to meter supplies to such pieces of apparatus. But control of the size and number of geysers, cooking stoves, and gas fires in private houses would not necessarily imply close control of consumption, and in consequence such pieces of apparatus are hardly ever given unmetered supplies. Even in such cases as these, however, the fact that most gas appliances have to be fixed permanently to the distributing system, and that only one sort of use can be obtained from a given appliance, permits a fairly close control of the nature of the consumption if not of its amount; and as has been said this is of great importance for the possibilities of price differentiation in the gas industry.

(*d*) *Conditions of Storage.*

The storage of gas is more costly than that of water and the storage capacity of gas undertakings is usually limited to not more than one day's supply. The manufacture of gas, however, is most economical when it is proceeded with at an approximately even rate throughout the twenty-four hours of the day. It therefore becomes more essential than in the case of water-supply to endeavour to 'smooth out' the peaks in the load-curve, and especially the annual and weekly peaks. This end may be achieved in at least two ways. One way is the encouragement, by means of advertisement and assistance in purchase, of the installation of apparatus in which gas is likely to be consumed only during the off-peak periods, or at least not exclusively during the peak periods. When the lighting load was the principal load of gas-undertakings, cooking and heating apparatus fulfilled this 'smoothing' purpose admirably; but the cooking and heating loads are now so much more important than the lighting load in many undertakings as to have built up fresh peaks and fresh problems of their own. Domestic refrigeration and any industrial processes which consume gas at a constant rate, or better still during off-peak periods only, are among the uses which many undertakings seek most to foster for this purpose at present. The other method is to encourage consumption during off-peak periods by means of a tariff which directly differentiates against peak consumption.

(*e*) *Area of Supply.*

The theoretical case for charging higher prices to customers who live outside a local government boundary is exactly the same in the case of gas as in that of water. In Germany, however, as elsewhere, the practical issue has recently been made much more important than it is in the water-supply industry by the development of the so-called 'Ferngas' movement. 'Ferngas' is gas which is transported over a long distance from its place of generation to its place of consumption. It was first supplied on a large scale in Germany by certain coke manufacturers. After cheap long-distance transport of this gas became possible, some local undertakings found that it paid them better to buy 'Ferngas' than to continue to manufacture gas themselves, and therefore entered into contracts with one or other of the coke manufacturers for the supply of gas, becoming themselves merely distributors. Some experts saw in this a danger of the gas industry becoming 'octopoid' in a more sinister sense than that usually attributed to it; others saw in it nothing more alarming than a natural application of 'the law' of large-scale production. Some ordinary gasworks began to supply 'Ferngas' on their own account, reaching out tentacles into the enemy's territory as well as grappling with him at home. The question is by no means settled yet, and it is impossible to forecast whether those who wish to see the whole country supplied from a few central generating plants or those who wish to see the industry remain decentralized will gain the day. In any case, even if the problem should develop no further, the possible area of supply from a single centre has been greatly enlarged, and it is now hardly true to say that 'gas lighting is the only one of the public utility industries for which the most economical area of management at the present time does not exceed the municipal area'.[1] And with the increase in area of management has gone an increase in the problems connected with differentiation between districts. 'Of chief importance in this connexion are the questions: whether a minimum consumption of gas can be insisted upon, whether the most-favoured-treatment clause is to be adopted, whether and in what way the price of gas is to be fixed by coal-, wage-, or other clauses. Also the condition of the gasworks plays an important part, i.e. whether, owing to the increase of consumption due to the undertaking of long-distance supply, increased capital for old or new plant becomes necessary.'[2]

II. SOCIAL CHARACTERISTICS

(*a*) *Importance to the Community.*

Gas is not such an urgent necessity for personal life as water is. It nevertheless remains sufficiently important to render certain kinds of price differentiation intolerable to present-day society. It is also one of the chief sources of power for industry, and as such cannot be said to be much less of a necessity than water, except so far as account is taken of possible substitutes, of which for water there are none. But the use of gas instead of oil or solid fuel may be beneficial to the community in general in less direct ways. 'If the use of gas for power, heating, and cooking purposes can be encouraged by preferential treatment, the consumption of coal in a town should be reduced and the smoke nuisance abated, which in many towns is a consideration of considerable importance.'[3] A regulating authority with such views as these would possibly be disposed to differentiate in favour of small consumers by remitting at least a part of what might otherwise be the prohibitive burden of their customer costs.

---

[1] Pigou, *Economics of Welfare*, p. 401.

[2] Dr. R. Nübling, 'Der Stand der Gastariffrage', *Das Gas- und Wasserfach*, Aug. 31st, 1929, p. 861.

[3] Knoop, op. cit., pp. 200-1. Professor Knoop's other example of the way in which the welfare of the inhabitants of a district may be promoted by a suitable gas-price policy is not so happy.

(*b*) *Consumption by the Community.*

What has been said on the subject of differentiation of water prices between private and communal consumption applies also to differentiation of gas prices, with the exception that the only really important communal use of gas, for street lighting, is being more and more substituted by electricity. The remainder of the communal consumption of gas, for heating public buildings, &c., is rather insignificant. Thus the question has not the degree of importance of the corresponding water-supply problem.

As with water-supply, there is no one method of charging that will satisfy all economic and social ideals. The same cost considerations render differential prices likely, although as overhead costs are not so prominent the resulting differentiation is likely to have a smaller range. Conditions of storage and demand also render differentiation probable—more probable than in the water-supply industry, because while the demand for gas fluctuates more than that for water, the power of meeting it by storage is less. Social considerations are not so urgent as those concerning water, but they are nevertheless far from negligible and provide arguments against certain types of differentiation and even for other types of differentiation.

There are, however, three quite new elements in the case. The first of these is the practical impossibility of estimating even domestic consumption, except of certain comparatively unimportant kinds. This, together with the fact that the average household expenditure on gas is much higher than that on water,[1] makes the metering of all ordinary supplies of gas a practical necessity. The second new element is the fact that gas is used in 'fixtures' and not usually transported from the distributing system before use. This makes possible differentiation of charges according to the use to which gas is put to an extent that is quite impossible with water. The third new element is the competition of substitutes for gas. Since this competition is more keenly felt in some fields of consumption than in others, one of its effects is to encourage differentiation of prices.

---

[1] See Table XIX, p. 73.

FURTHER READING ON CHAPTER VI

KNOOP, D. *Principles and Methods of Municipal Trading.* (See note on Chap. IV.) Special reference in connexion with this and the succeeding chapter should be made to pp. 200–22.

DEUTSCHER VEREIN VON GAS- UND WASSERFACHMÄNNERN: *Das Gas- und Wasserfach.* (See note on Chap. V.)

Among recent articles dealing particularly with gas charges may be mentioned:
Schomburg: 'Über Gaspreisbildung', vol. lxvii, 1924.
Various authors: 'Gaspreis und Gastarifbildung', vol. lxxi, 1928.
R. Nübling: 'Der Stand der Gastariffrage', vol. lxxii, 1929.
A. Strölin: 'Selbstkosten und Gastarife', vol. lxxii, 1929.
A. Schäfer: 'Marktanalyse, Werbung und Tarif', vol. lxxiii, 1930.

CHAPTER VII

GAS-SUPPLY: CHARGES

I. CLASSIFICATION OF CUSTOMERS

It may be said that in the gas-supply industry the classification of customers into groups is the rule, and in the water-supply industry the exception. Only one of the twenty-eight gas undertakings in the largest German towns deals with all customers by the same tariff; fifteen of the twenty-eight water-supply undertakings do so. The average number of customer groups per gas undertaking is just under 3¼, per water undertaking just over 1½.

This greater degree of customer classification in the gas industry is due chiefly to certain characteristics of the industry that have already been referred to—the comparative ease with which gas-supplies can be tied down to certain uses, and the varying elasticities of the demands for these different uses.

Purely theoretical considerations would seem to dictate that customer-classification should be regarded as a last resort, only to be employed when it is impossible to express a price-policy within the limits of a single tariff. If this rule is strictly followed, customer-classification will be resorted to only when it is desired to differentiate between the prices of what consumers regard as equivalent commodities, i.e. customer-classification will be employed solely as a 'discriminatory' device. Differentiation between the prices of what consumers regard as essentially different commodities can always be achieved within the limits of a single tariff. In the gas-supply industry, for example, differentiation between summer supplies and winter supplies does not necessitate a classification of customers into two groups; but differentiation between cooking supplies and heating supplies does. The chief reasons for preferring to differentiate within a tariff rather than by means of separate tariffs are, firstly, that almost any customer-classification is regarded by consumers as *a priori* unreasonable, and secondly, that an increase in the number of tariffs offered by an undertaking means an increase in many of its administrative expenses.

Some authorities consider that the amount of customer-classification in the German gas-supply industry has already passed the desirable limit. Thus the director of the Detmold gasworks, speaking at a conference of experts in 1929, complained that 'if you have the gas tariffs of some towns sent to you, you get a little booklet. Whoever can master such tariffs deserves to be created Doctor of Tariffology, and yet the consumer is supposed to understand it all.'[1] At a similar conference in the previous year the director of the Mannheim works had expressed the opinion that 'the ideas of differentiation and individualization are already overdone'.[2] It is difficult to deny to most undertakings their right to 'industrial' and 'heating' tariffs besides the ordinary domestic tariff. Whether special tariffs are necessary when gas is supplied through prepayment meters, whether groups of alternative tariffs should be employed,[3] and whether special tariffs need to be constructed where local conditions are unusual, are more debatable questions.

It is important to note that a customer-classification may be disguised by being embodied in what appears to be a single tariff but is in reality a conglomeration of different tariffs. An extreme example of this, which appears also to be an example of the type of customer-classification that should be avoided, is provided by the Biebrich tariff.[4] Under this 'tariff' customers are divided into groups, each group having a 'basic consumption'. The tariff applicable to each group is of the block type and was as follows in 1928:

Basic consumption	22 pf. per cub. m.
Additional consumption up to double basic level	15 pf. per cub. m.
All additional consumption . . .	10 pf. per cub. m.

The form of the individual tariffs, the more so since at least 5 cubic metres per month has to be paid for whether consumed or not, is free from objection. But the basis of the grouping is open to serious objection.

The grouping was performed more or less arbitrarily by the undertaking itself, its chief criteria being, in order of significance:

1. Maximum monthly consumption in 1925.
2. Size of meter.
3. Occupation of consumer.
4. Nature of gas installation.

---

[1] Herr Falck, in *Das Gas- und Wasserfach*, 7th Sept., 1929, p. 884.

[2] Herr Egetmeyer, ibid., 14th April, 1928, p. 350.

[3] See pp. 134 f.

[4] See *Das Gas- und Wasserfach*, 1928, pp. 348-50.

Where the monthly consumption was 10 cubic metres or less, the consumer was placed in Group I; where it was between 10 and 20 cubic metres, in Group II; and so on, half-groups at intervals of 5 cubic metres being created in some cases. The results so obtained were then modified by consideration of the other three chief criteria, a higher grouping being accorded to consumers with abnormally large meters and a lower to consumers with very low incomes. Where the existing installation was very large or very small in comparison with the consumption, the grouping was again modified where necessary in order to provide the consumer with a motive for increasing his consumption.

Consumers were allowed to appeal against their classification, but complaints were relatively few and invariably dealt with to the satisfaction of both parties by a measure of de-grading. According to the superintendent of the undertaking, 'the new tariff is understood by the consumers and felt to be just.... The free estimation of the basic consumption, which seemed to many at first to be a defect, soon proved itself to be the strongest point of the group tariff.'[1] It is nevertheless a little difficult for the detached observer not to attribute the success of this tariff rather to the unusual tact and skill of the superintendent and his staff than to the arbitrariness of their method. In general, public opinion can only be induced to accept such classification as is based upon universal and simple rules. It is only fair to record that the Biebrich tariff has a confessedly 'social' aim, and since this fact was cleverly advertised it may be the explanation of the public satisfaction with the grouping, the little wrongs of individual arbitrariness being excused for the sake of the great right of general social justice.

In the last chapter four particular cases of customer-classification in the water-supply industry were examined, in which special charges were made for water for fire-plugs, river-water, water for public purposes, and supplies outside the city limits. The first two cases naturally find no counterpart in the gas-supply industry. The third might be expected to do so, and undoubtedly would have done so in earlier times when streets were universally lit by gas; but in the tariffs of the twenty-eight towns of the present investigation no special price is quoted for public supplies as such. And of the twenty-eight undertakings, none quotes a special price for supplies of gas outside the city boundaries, although three undertakings make this distinction for water. It is possible, however, that some undertakings differentiate in this way without announcing the fact in their ordinary published tariffs.

---

[1] See *Das Gas- und Wasserfach*, 1928, p. 350.

Apart from the above special cases, customers are divided into tariff groups by water undertakings on six occasions only—twice on grounds of mere convenience, once on purely social grounds, once on grounds that are not disclosed, and twice on purely economic grounds. The remaining twenty-three undertakings provide one main tariff only. In the case of gas-supply, thanks largely to the fact already mentioned that both the demand and the supply conditions of gas vary greatly according to the use to which it is to be put, these proportions are more than reversed. Of the twenty-eight undertakings considered, only one deals with its customers by a single tariff, and the remaining twenty-seven use two, three, four, or even as many as seven tariffs, for as many different classes of customers. Seventeen undertakings quote special tariffs for gas used for heating purposes, and twenty-five quote special tariffs for gas used for industrial and business purposes. In three of these twenty-five cases, the special tariff applies to gas used for both industrial and heating purposes. In addition, eight undertakings have special tariffs for gas used for other purposes. These purposes include: (i) the heating of water in washhouses (Hanover and Königsberg); (ii) certain special industrial or business or domestic uses (Dresden, Frankfort, Stuttgart); (iii) supplies to combined business and private premises (Gelsenkirchen); and (iv) otherwise undefined 'very unusual circumstances' (Altona). The purposes of these special tariffs seem to be either the recognition of certain economies of supply, the securing of custom that could not be obtained at the ordinary prices, or mere administrative convenience.

There are several possible reasons for granting special rates to industrial consumers. Sometimes an increased industrial demand would improve the annual load-curve of an undertaking, and an attempt is therefore made to stimulate such a demand by means of preferential rates. More frequently, the practice of differentiating in favour of industrial consumers is a case of charging what the traffic will bear, i.e. a case of discrimination in its wider, ethically neutral, sense. An industrial demand may not improve the load-factor of an undertaking, but it may by filling unused capacity, however irregularly, improve the capacity-factor. In such a case, it will pay the undertaking to cater for that demand, even if the price obtained only slightly exceeds the prime costs incurred. And very frequently, this will be all that the undertaking is able to obtain. For what Dr. Strölin has called the Convenience Factor is of relatively little importance in industry, and the competition of other fuels is much more likely to be felt than in the domestic sphere. In the business world 'the consumer will think perhaps in terms of fractions of a farthing when making comparisons with the cost of solid fuel. In such cases gasworks will often have to meet this competition and content themselves with a profit of fractions of a farthing.'[1] 'The movements of coke, coal, oil, wood, and especially electricity, prices must therefore be watched constantly. In the observation of these prices there is the difficulty that direct comparisons are impossible, and that figures must be translated into terms of thermal units and efficiency. . . . The price tactics pursued by competing fuels must also be watched carefully, for the purpose of making possible counter-moves.'[2] The amount of preference given to industrial consumers of gas will therefore depend greatly on local conditions, such as the nature of the gas-using industries, the prices of other available fuels, &c.

Differentiation in favour of industrial consumers is sometimes justified on the ground that 'it is cheaper to supply in large quantities'. Since this comparative cheapness, where it is not entirely mythical, arises solely from the fact that the customer costs of large consumers are spread out over a larger number of units than are those of small consumers, it cannot logically form a basis for differentiation, but merely for accurate imputation of customer costs. It is safe to assume that where discounts are granted to industrial consumers as such, the real reason for this differentiation is in nine cases out of ten the necessity for competing with other fuels; and in the tenth case, a conscious or unconscious recognition of load-curve considerations.

In every case but one, where undertakings charge special prices to industrial consumers in the twenty-eight towns of the present investigation, the price of any quantity of gas under the industrial tariff is at least as cheap as, and sometimes much cheaper than, the price of the same quantity under the ordinary tariff. The sole exception is the Gelsenkirchen scale, under which certain small quantities of gas cost more by the first industrial tariff than by the second domestic tariff.

---

[1] Herr Schomburg, 'Über Gaspreisbildung', *Das Gas- und Wasserfach*, Aug. 9th, 1924, p. 465.

[2] Dr. R. Nübling, 'Der Stand der Gastariffrage', ibid., Aug. 31st, 1929, p. 861.

In 1912 Professor Knoop wrote: 'Whilst recognizing the desirability of extending the sale of gas for power, cooking and lighting purposes, many towns are inclined to the view that it is best to charge a uniform price for lighting, cooking and heating purposes, if not for power.'[1] The loss of the lighting demand, which lay behind such a view as this, was still an event of the future when Professor Knoop wrote, and he was therefore able to explain the situation in the following terms: 'As the consumption of gas for other than lighting purposes becomes considerable, the financial position of the undertakings may be seriously affected if preferential rates are granted. Thus in Düsseldorf and Mannheim, for example, the consumption of gas for cooking and heating purposes represents more than half the total consumption of gas by private customers; so that it is hardly astonishing that in 1910 these undertakings should have changed their tariffs to do away with the preferential rate for gas cooking and heating purposes.'[2] In recent years, it is safe to assume, the consumption of gas for cooking and heating purposes would represent *most* of the total consumption of gas by private customers in any city, and it is therefore still less a matter for astonishment that the preferential tariff for gas for cooking purposes should have entirely disappeared from the scales of charges of the twenty-eight undertakings specially dealt with in the present work. The preference for gas for heating purposes is still given in twenty cities, however, including Mannheim and Düsseldorf again. It is not impossible to guess the reasons which have dictated the retention of this particular preference when that for cooking-gas has entirely disappeared. Probably direct load-curve considerations have little to do with the matter. If the competition of substitutes is felt more keenly in the field of heating than in that of cooking, it is easy to imagine why special concessions should be made in the one and not in the other. That this is the motive, in Gelsenkirchen at least, may be gathered from the following words of the Director of the Gelsenkirchen gasworks: 'In thousands of cases, for example in the kitchen and in the bathroom, the cleanness and convenience of gas is highly valued, and payment is made accordingly, all the more if the competing fuel, as is the case with coal-fires, is extremely uneconomic. It would be very foolish to reduce such prices unnecessarily when they are rightly accepted as "reasonable" or "cheap". Admittedly, the case of heating by gas is essentially different. The whole German nation has become poor, and nobody can now afford to pay for mere convenience, however considerable, in connexion with such an important item of expenditure as that for heating. On the other hand, we must considerably increase the gas-consumption of our most important consumers, the domestic consumers, which at present consists chiefly of cooking-gas. . . . We must therefore supply cheap gas for heating, especially in districts where coal-fires are commonly used instead of gas-stoves for cooking in winter, and cooking-gas is consequently not in demand. We must naturally fix a reasonable, competitive price for this heating-gas, substantially lower than that for cooking or geysers.'[1]

---

[1] Knoop, op. cit., p. 207.

[2] Ibid., pp. 207-8.

In all of the twenty above-mentioned cases in which undertakings quote a special price for heating-gas, that price is lower than the price for a corresponding quantity of gas at the ordinary rate. The prices for heating-gas compare with the ordinary prices as follows:

TABLE XXII

Charges for Heating-gas

Town	*Ordinary Domestic price, in pf.*	*Price of Heating-gas, in pf.*	*Remarks*
Hamburg	17*	13*	
Cologne	23*	10*	
Munich	20*	12*	
Leipzig	18*	12*	
Dresden	17	10	Fixed charge from 40 monthly. No fixed charge for heating gas.
Breslau	21	11	
Frankfort	10	7	Fixed charges amount to roughly the same.
Essen	18·5*	5·2*	
Düsseldorf	18*	12*	Heating tariff applicable only when annual consumption exceeds 1,200 cub. m.
Hanover	15*	9*	

---

[1] Herr Schomburg: 'Über Gaspreisbildung', *Das Gas- und Wasserfach*, Aug. 9th, 1924, p. 465.

Table xxii (*cont.*)

Nuremberg	16	10	
Stuttgart	17	9	Fixed charges amount to roughly the same.
Gelsenkirchen	12*	6*	
Königsberg	12	9	Fixed charge from 50 monthly. No fixed charge for heating-gas.
Stettin	19	10	
Mannheim	16*	12*	
Bochum	18*	18*	But heating-gas price only 8 after the first monthly 100 cub. m.
Kiel	10*	9*	
Halle	22	12	
Elberfeld	16	7	Heating-gas tariff applicable only where monthly consumption exceeds 500 cub. m.

* Same scale of standing charges payable under both tariffs.

In all cases the prices given are those which the consumer of the smallest quantities has to pay. In many cases there are discounts for larger quantities under the ordinary tariff, less frequently under the heating-gas tariff.

In eight[1] cities gas is supplied to certain classes of customer through prepayment meters. The slot-meter necessary for this system is more expensive than the ordinary type of meter, but the additional cost does not seem to be systematically added to the price of the gas. The following table shows the prepayment prices as compared with the ordinary prices for domestic supplies.

It will be observed that in Dresden, Stuttgart (Tariff I), Gelsenkirchen, and Altona, the first few cubic metres monthly are actually cheaper under the slot-meter tariff than under the ordinary tariff, owing to the remission of meter rents. After a certain (low) level of consumption has been reached, however, which depends upon the size of the meter in use, prepaid gas becomes dearer than ordinary domestic gas. In Leipzig, Duisburg, and Kiel, ordinary small consumers pay the same prices under both tariffs, as do consumers of not more than 9 cubic metres monthly in Magdeburg. Consumers of more than 9 cubic metres monthly in Magdeburg pay *less* through a slot-meter than under the ordinary tariff.

In Stuttgart slot-meters are also employed in wash-houses which are used by more than one family, such as are commonly to be

---

[1] Eight cities publish prepayment-meter tariffs; other cities may supply gas at the usual rates through prepayment meters without specially announcing the fact.

TABLE XXIII

Prepayment Charges for Gas

Town	*Ordinary Domestic price, in pf.*	*Slot-meter price, in pf.*
Leipzig	18*	18*
Dresden	17 + R	20
Stuttgart I	17 + R	18 Slot-meter gas for cooking only.
Stuttgart II	11	11 For gas supplied to wash-houses.
Gelsenkirchen	12 + R	12·9
Magdeburg	20 + R	20 + R but no standing-charge payable when monthly consumption exceeds 9 cub. m.
Duisburg	17	17
Altona	18 + R	20
Kiel	10 + R	Average unit price paid in previous year.

* Same scale of standing charges payable under both tariffs.

R = Standing charge.

In all cases the prices given are those which the smallest consumers have to pay. In many cases discounts are given for larger consumption under the ordinary tariff (see Table XXV).

found in the new blocks of dwellings erected in Germany since the War. The principal object in this case is to provide some method of payment that will enable different consumers to use gas in the same apparatus and pay for it separately. The chief pros and cons of slot-meter supply have been admirably summarized as follows: 'Bills, which are not liked, are dispensed with; and incidentally labour and personnel are economized. Consumption among small consumers increases. Demand and payment for gas or current occurs simultaneously, and large bills which cannot be presented simultaneously with consumption are dispensed with. The cutting-off of supplies owing to default of payment becomes unnecessary. The difficulties connected with the installation of sub-tenants' meters, necessitated by the housing-shortage, disappear. The chief disadvantages are: the meters must be installed in the consumers' dwelling; meters which cannot be placed in protected rooms may be rifled. The cost of a slot-meter is greater than that of an ordinary meter. And if heating stoves or geysers are included in the installation, accidents may occur.'[1]

---

[1] *Das Gas- und Wasserfach*, Jan. 15th, 1928, p. 408.

II. TARIFFS

Four principal types of water tariff were dealt with in Chapter V. These are all in use in the gas-supply industry. The fixed-charge tariff, for reasons mentioned on pp. 109–18, is not used at all for gas in the towns investigated.

In the twenty-eight towns investigated, 90 gas tariffs are in use, including 11 cases in which special prices may be quoted in special circumstances although no list of such prices is published. Of the 90 tariffs, 39 are one-part and 50 two-part. Of the 39 one-part tariffs, 19 are pure flat-rate tariffs, 6 of them for heating-gas, 8 for ordinary domestic, and 5 for prepayment meter supplies. No undertaking relies entirely upon flat-rate tariffs for dealing with all its customers. The remaining 20 one-part tariffs provide for some kind of discount for purchase in large quantities—sometimes by means of direct discounts to purchasers of more than stated quantities, sometimes by means of block discounts, sometimes by means of individual contracts with large consumers as such. These special contracts are usually available for industrial consumers only, but the rest of these discount tariffs are employed fairly equally for all types of customer. The exact distribution of the various types of tariff among different classes of consumer may be seen from Table XXIV.

Of the 50 two-part tariffs, 21 are in the form of a flat rate with a fixed monthly or annual charge. No undertaking relies entirely upon this type of tariff for dealing with all its customers. The remaining 29 two-part tariffs combine discounts for quantities with 'meter rents' or other standing charges. The methods of giving discounts are as varied as in the one-part tariffs, but in the majority of the two-part tariffs the discount is of the block type. Several undertakings employ two-part tariffs exclusively.

It will be observed that the two-part tariff is considerably more popular than the one-part, which is confined chiefly to subsidiary and 'special-contract' groups of customer.

The principal objection to one-part tariffs is that they fail to give accurate recognition to customer-costs. 'Hence, merely as a matter of tariff policy, and quite apart from other points of view, the two-part tariff appears to be the most suitable form of gas-tariff.' An incidental advantage of the two-part tariff is that it encourages the consumer to increase consumption by offering him progressively falling prices.

The chief objections to the two-part tariff are: (i) that its employment involves the undertaking in extra book-keeping work;

TABLE XXIV

Types of Gas Tariff[1]

	GROUP OF CUSTOMERS TO WHICH APPLICABLE					
Type of tariff	*Domestic or general*	*Slot-meter*	*Industrial*	*Heating*	*Other*	*All*
One-Part:	8	5	14	6*	6	39
Flat-rate .	5	4	1	5	4	19
Discount:	3	1	13	1*	2	20
Step . .	1	—	1	1*	—	3
Block . .	2	1	3	—	—	6
Compound and special .	—	—	9	—	2	11
Two-Part:	20	2	11	11‡	6	50
Flat-rate .	11	1	—	6	3	21
Discount:	9	1	11	5‡	3	29
Step . .	1	—	6	2*	—	9
Block . .	6	1	4	3*	3	17
Compound .	2	—	1	—	—	3
Compound .	—	1	—	—	—	1
TOTAL . .	28	8	25	17†	12	90

* Plus 1, also for industrial consumers.
‡ Plus 2, also for industrial consumers.
† Plus 3, also for industrial consumers.

---

[1] It is interesting to compare the above figures with those given by the Verein von Gas- und Wasserfachmännern, which relate to the tariff situation on Jan. 1st, 1930, among 804 German gas undertakings. These show that of the domestic tariffs, 14 per cent. were flat-rate, 16 per cent. discount, and 70 per cent. two-part; of the industrial tariffs, 6 per cent. flat-rate, 23 per cent. discount, and 70 per cent. two-part; and of the heating-gas tariffs, 20 per cent. flat-rate, 10 per cent. discount, and 70 per cent. two-part. In every case this shows a considerable decrease in the proportion of flat-rates tariffs as compared with 1929, a smaller decrease of discount tariffs, and a 5 or 6 per cent. increase of two-part tariffs. (See 'Zur Frage der Gastarife: Die Gaspreisstatistik nach dem Stand vom 1. Januar 1930', by Dr. Strölin, in *Das Gas- und Wasserfach*, May 24th, 1930, pp. 505-7.) These statistics do not take account of slot-meter tariffs, which were used by 113 undertakings.

The corresponding statistics for the following year show a continuation of this 'flight from the flat-rate', but the general state of the country's finances at that period would hardly permit these figures to be regarded as strictly comparable with the foregoing. Only 713 undertakings contributed to the statistics. Of these, 158 or 22 per cent. had altered their tariffs during the period Oct. 1st, 1929—Sept. 30th, 1930. The number of slot-meter tariffs had increased to 180; and apart from these, 41 undertakings had alternative tariffs. (See *Das Gas- und Wasserfach*, April 18th, 1931, pp. 370-1.)

TABLE XXV

Customer-groups for Gas Tariffs

		TARIFF GROUPS				
Town	*No. of tariffs*	*Domestic or general*	*Slot-meter*	*Industrial*	*Heating*	*Other*
Berlin	1	BR	—	—	—	—
Hamburg	2	FR	—	SR*	*	—
Cologne	3	BR	—	BR	SR	—
Munich	3	Comp. 2-pt	—	X	FR	—
Leipzig	4	BR	FR	X	FR	—
Dresden	6	FR	F	SR	F	FmR Sp. dom. FmR Sp. ind.
Breslau	3	F	—	Xm	F	—
Frankfort	3	FmR†	—	—	FmR	Fm Sp. dom.
Essen	3	FR	—	S′R	S′R	—
Dortmund	2	BmR	—	X	—	—
Düsseldorf	2	FR	—	BmR*	*	—
Hanover	4	IR	—	X	FR	FR
Nuremberg	4	F	—	B	F	X
Stuttgart	6	FR	F	SR	FR	F wash-houses F Sp. dom.
Chemnitz	2	F	—	X	—	—
Gelsenkirchen	7	Comp. 2-pt	BR	Comp. 2-pt	BR	BR Business BR Sp. dom. I BR Sp. dom. II
Bremen	2	FR	—	BR	—	—
Magdeburg	2	BR	Comp.	—	—	—
Königsberg	4	FR†	—	Fm	F	F
Duisburg	3	Bm	B	Bm	—	—
Stettin	3	F	—	Comp. 1-pt	S	—
Mannheim	3	BR	—	BR	BR	—
Altona	4	FR	F	IR	—	X
Bochum	3	FR	—	SR	BR	—
Kiel	4	F′R†	F	X	F′R	—
Halle	3	F	—	X	F	—
Barmen	2	B	—	B	—	—
Elberfeld	2	S	—	S*	*	—
TOTAL	90	28	8	25	17″	12

Key to Table XXV:

′ With coal clause.
† With maximum flat-rate price for total consumption.
‡ Same tariff for two groups in three additional cases.
* Same tariff for two groups.
For other abbreviations see Table XX, p. 89.

(ii) that consumers are apt to be a little suspicious of it; and (iii) that it tends to drive away the custom of very small consumers.

The first objection is well grounded, and the cost of the extra work involved must be balanced by the undertaking against the increase in net revenue likely to arise from the introduction of a two-part tariff. It is only in very unusual circumstances that this cost would outweigh the gain, however. The second objection is also well grounded, but the remedy is obvious. It is not difficult to educate a body of consumers to an appreciation of the reasonableness of the standing-charge principle even though it means 'paying for what you haven't had'.

The third objection does not appear to have a firm economic basis. It is true that some small consumers are likely to be worse off under a two-part than under a one-part tariff; but to regard this as an economic objection to the two-part tariff is unwarranted. For, in the first place, it is by no means certain that a small consumer will be dissuaded from using gas by the introduction of a two-part tariff; he may be persuaded by it to use more. If a certain small consumption has become less worth while to him thereby, a higher level of consumption may have become more worth while. In Kiel, for example, before the new two-part tariff was introduced, a consumer living in a three-roomed dwelling (kitchen, bath-room, &c., not being included) would have paid 10 marks annually for an annual consumption of 50 cubic metres of gas. After the introduction of the new tariff, he would have to pay for the same quantity of gas 5 marks plus a standing charge of 2·50 marks per month, making a total charge of 35 marks. Whereas he had previously found it worth while to use gas for lighting at an average price of 20 pf. per cubic metre, he might no longer find it worth while at an average cost of 70 pf. per cubic metre. Nevertheless, to cease using gas altogether is not his only alternative. He may consider the possibility of using gas for cooking and heating as well. At an average price of 20 pf. under the old tariff this might have been beyond his means. But under the new tariff, an annual consumption of 600 cubic metres would cost only 600×10 pf. + 12×250 pf. = 90 marks, or 15 pf. per cubic metre. It is interesting to note that the general consequence of the introduction of the new tariff in Kiel was that, of 60,000 consumers, only 900 were driven away by the new tariff, and that the total consumption increased by 25 per cent. within six weeks.[1]

And, in the second place, it seems mistaken to assume that the discouragement of very small consumers is an economic disadvantage. The Superintendent of the Kiel gasworks, speaking of those customers which his undertaking had lost through the introduction of the two-part tariff, pointed out that: 'These 900 were presumably people who have cost us a great deal of money and who to a certain extent have obtained low prices for themselves at the expense of the good consumers. That is not the purpose of the tariff, nor of the gasworks. The tariff should be as just as possible, and the two-part tariff alone is just for both parties.'[1] 'We have absolutely no motive for favouring or retaining customers, such as we actually have had in Kiel in large numbers, who consume less than 10 cubic metres per year, and consequently cost us for meters, book-keeping, &c., more than they pay us altogether.'[2]

---

[1] *Das Gas- und Wasserfach*, 1924, p. 469.

The number of consumers who cost gas undertakings more than they pay them is probably much larger than is generally realized. The Superintendent of the Vienna gasworks recently reported on an interesting investigation that he had made in this connexion, taking as his basis three of the largest undertakings in Germany and Austria. 'The results of this investigation are very unpleasant. About 25 per cent. of all the customers of these undertakings are unprofitable.'[3] There can be no possible economic reason for seeking to retain the custom of such customers as these.

Unprofitable customers may admittedly be retained on *social* grounds. It is sometimes argued that the large consumer can well afford to subsidize the small consumer and that social justice demands that he should do so. Such arguments carry much weight in the water-supply industry; in the gas-supply industry they seem to be sometimes misapplied, however. For although gas may be considered sufficiently important for public health by some local authorities to justify their assisting poor consumers to purchase it,[4] there seems to be no adequate justification for assuming that small consumers of gas are necessarily or even probably poor people. General information on this matter is not available; but there is good reason for believing that conditions in Stuttgart, where the matter was recently investigated, are not untypical of conditions elsewhere in Germany.

---

[1] Ibid., loc. cit.

[2] Ibid., loc. cit.

[3] *Das Gas- und Wasserfach*, 1929, p. 882. In Vienna all customers who consumed less than 24 cubic metres per month were 'unprofitable'.

[4] See p. 117.

This investigation, undertaken by Dr. Nübling in 1928, revealed the fact that, of the 2,000 consumers who used less than 10 cubic metres of gas per month, only 4·9 per cent. were in receipt of very small incomes. Of the remaining cases of small consumption, 33 per cent. were due to the use of gas for certain purposes only, coal or electricity being used for other purposes, 32 per cent. were due to special circumstances which had nothing to do with income, and 30 per cent. were due to temporary causes such as illness, absence from home, &c. It is difficult to find any ground, economic or social, for subsidizing the gas consumption of such consumers as form these three groups. And as for the remaining 5 per cent., there is much to be said for the point of view that any public assistance that is extended to them should be given directly through an appropriate department of the local government and not in a disguised form through the gas or electricity works.

Nevertheless, the probability of dissatisfaction on the part of small consumers remains the principal objection to the two-part tariff. 'The effect of this dissatisfaction is also seen in the fact that in nearly all the gasworks which actually have introduced or have attempted to introduce the two-part tariff, it has had effect only as an *alternative tariff*',[1] i.e. the consumer has been left free to choose whether he will be charged according to the two-part tariff or according to some other tariff, usually a flat rate.[2] Such a solution is not to be recommended,[3] except perhaps as a temporary device. The peculiar advantage of the two-part tariff is that it charges small consumers with their proper share of costs; the effect of an 'alternative' tariff is to allow them to escape payment of this share.

The chief practical difficulty associated with the construction of a two-part tariff is that of fixing the standing-charge element. It should obviously cover customer costs. Whether it should cover other overhead costs is a moot point. There is no hard-and-fast rule for dividing general overhead costs, and while some authorities prefer to divide them equally among all units of product, or equally among all units of product supplied to consumers in a given class —as is usual in the water-supply industry—others prefer to divide them equally among consumers in a given class.

---

[1] *Das Gas- und Wasserfach*, 1928, p. 350.

[2] In accordance with the definitions given on p. 88, a group of alternative tariffs constitutes in reality one tariff only. As a matter of convenience, however, alternative tariffs have been reckoned separately in the tables given in this book. This course is also justifiable to some extent even from the point of view of strict theory, since consumers are not normally left free to change from one alternative tariff to the other, except at fixed times and under fixed conditions.

[3] And does not seem to be so widely adopted at the present time.

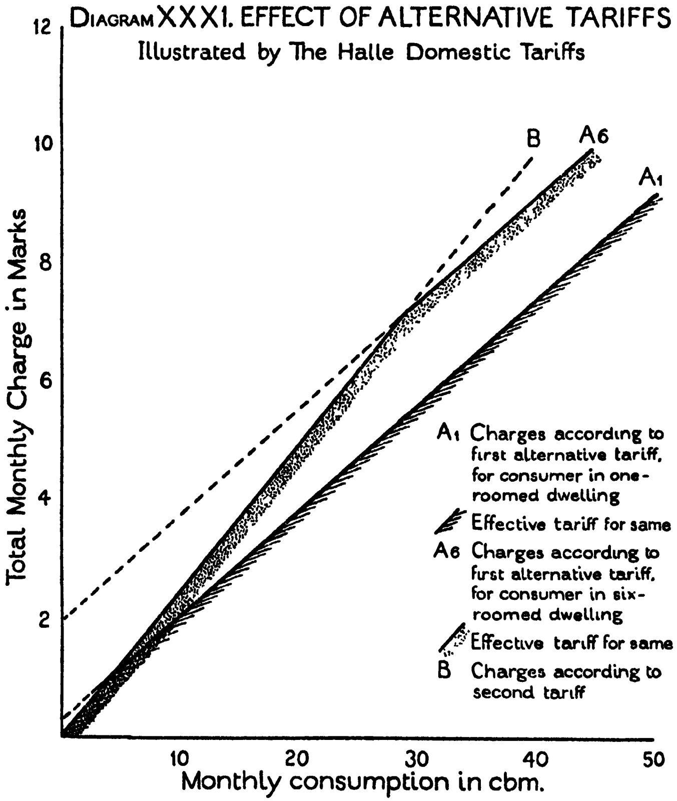


DIAGRAM XXXI. EFFECT OF ALTERNATIVE TARIFFS
Illustrated by The Halle Domestic Tariffs

There is again no general agreement as to the way in which the various overhead costs should be charged to different customers. 'The standing charge can be fixed as a uniform charge, i.e. as one that is the same for all consumers, or as a "step" charge, i.e. as a charge which varies for different groups of consumers.'[1] The chief objection to the uniform standing charge is that it cannot accurately cover customer costs except where consumption is of an unusually uniform nature, and that this inaccuracy is of such a kind as to increase the difficulties of introducing the two-part tariff by unduly and unnecessarily burdening the small consumer. On the other hand, a uniform charge is the simplest kind of charge to deal with and may perhaps conform to certain elementary notions of justice held by consumers.

---

[1] *Das Gas- und Wasserfach*, 1928, p. 328.

If a graded charge is adopted, some standard of grading is necessary. The most usual standards are (i) the capacity of the installation; (ii) the average previous consumption; (iii) the size of the meter; and (iv) some indirect measure of the size of the house. Each of these standards has its peculiar advantages. The first (capacity of installation) probably permits the closest approximation to a correct division of customer costs. The second (previous consumption) is very easy to reckon from, and encourages all consumers to increase their consumption by offering them a lower price for all additional consumption. The third (size of meter) is also easy to reckon from, and, in the form of a 'meter rent', is accepted by consumers as reasonable. The fourth (number of rooms, rental value, &c.) is recommended chiefly on 'social' grounds, but has also its economic justification in that it approaches to a division of overhead costs according to 'what the traffic will bear'. Each standard also has its peculiar disadvantages. The first is not easy for the consumer to understand, discourages the installation of additional apparatus, and involves much work for the undertaking. The second also involves much extra calculation, and may cease to have any semblance of reasonableness if the consumption during the scheduled period was unusually high or unusually low. And, like the method of awarding 'progress' marks at school, this method is a little unfair to those who have unfluctuatingly high levels of achievement. The third method is likely to encourage consumers to demand smaller meters than their consumption really necessitates. And the fourth method involves a great deal of work, and fails to take account of the fact that, especially since the War, in Germany income is by no means necessarily proportioned to the number of rooms inhabited.

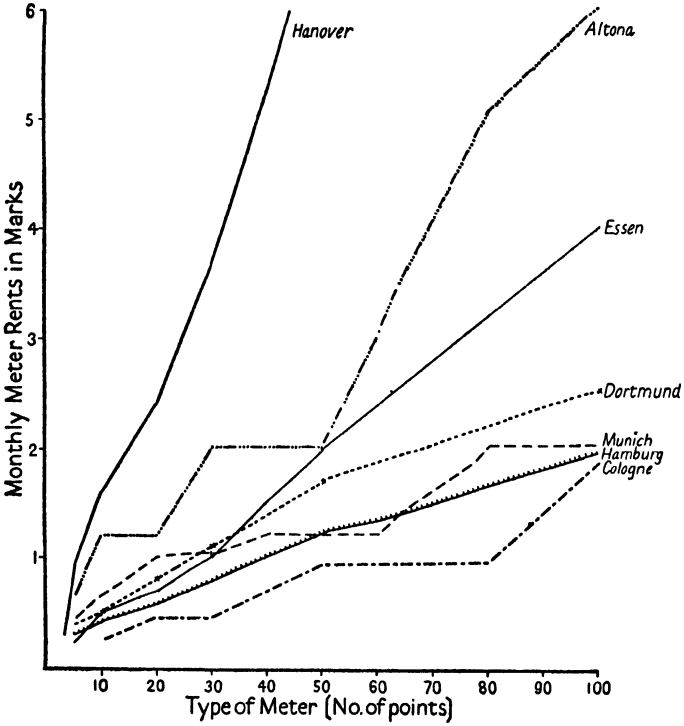
By far the most popular basis for the standing charge in Germany appears to be the size of the meter. Other bases, adopted by a few undertakings, are the number of rooms in or the floor area of the premises served, the consumption of a previous year, the consumption of the current year, and various combinations of these.[1]

---

[1] On Jan. 1st, 1930, among the graded standing-charge tariffs in use in 804 undertakings, 91 per cent. were based on the size of the meter, 4 per cent. on

The ideal gas tariff, like the ideal water tariff, would at least be easy to understand, simple to employ, 'economic', and 'just'. In consequence, the ideal gas tariff, like the ideal water tariff, is impossible of construction, since these four requirements are to some extent mutually contradictory. Social factors generally receive less attention in the gas than in the water industry, because gas is not hygienically so important as water, because the opportunities for using it are so much more varied, and—perhaps the most important factor of all—because it has to compete with substitutes. The opinion seems to be fairly generally held that 'hitherto in most works, gas prices have been fixed too much according to social and political points of view',[1] and the financial demands of local exchequers on publicly-owned gas undertakings tend to drive

DIAGRAM XXXII. METER RENTS IN GAS TARIFFS



---

the capacity of the installation, 3 per cent on the number of rooms served, and 2 per cent. on previous consumption. (See *Das Gas- und Wasserfach*, May 24th, 1930, pp. 505-7.)

[1] *Das Gas- und Wasserfach*, 1928, p. 347.

managers more and more towards purely economic principles of charging. The aim of the publicly-operated gasworks, as expounded by Dr. Strölin of the Stuttgart undertaking, does not differ remarkably from that of the works operated by purely self-seeking private owners: 'The final aim of all gas tariffs should be: by means of an increase of sales, to bring about a decrease of costs per cubic metre, in order to be able to sell at a cheaper rate and yet to earn higher total profits than previously.'[1] If we accept Dr. Strölin's premiss we must also accept his conclusion that although no possible tariff is ideal, the two-part tariff, probably based on a flat rate for domestic consumers and on a block scale for industrial consumers, with special provision made for heating-gas, is the nearest practicable approach to the ideal for the present situation.

FURTHER READING ON CHAPTER VII

See note on Chap. V.

KNOOP, D.: *Principles and Methods of Municipal Trading.* (See note on Chap. VI.)

DEUTSCHER VEREIN VON GAS- UND WASSERFACHMÄNNERN: *Das Gas- und Wasserfach.* (See note on Chap. VI.)

---

[1] *Das Gas- und Wasserfach*, p. 332.

CHAPTER VIII

ELECTRICITY-SUPPLY: CHARACTERISTICS

THE principal details in which electricity-supply differs from gas- and water-supply are the following:

I. ECONOMIC CHARACTERISTICS

(*a*) *Nature of Costs.*

Electricity involves the incurring of a higher proportion of *prime* costs than does water-supply but a smaller proportion than gas-supply. The principal prime cost of steam-generated current is the cost of coal. Where water is the motive power,[1] the prime costs become very small indeed. In such cases there is a marked effect on prices. It is nearly always water-power works that supply by fixed-charge tariffs, for instance. The *overhead* costs are rather like those of gas than those of water in that most of them need not be incurred many months in advance of demand.

(*b*) *Measurement of the Commodity.*

The lay mind has long been accustomed to measurements of capacity or volume but not to measurements of energy, and consequently found the notion of the kilowatt-hour somewhat difficult to deal with at first. After half a century, however, it is now generally accepted as a satisfactory 'unit' for the measurement of direct current. Meters for the straightforward measurement of kilowatt-hours can now be made much more cheaply than gas or water meters, and are therefore relatively unobjectionable as regards their influence on prices.

(*c*) *Structure of the Market.*

Electricity is demanded for two principal purposes, lighting and

---

[1] About ¾ of Germany's total production of electricity is generated from coal, ⅛ from gas, oil, and other fuel, and ⅛ from water. The proportions vary in different districts. In the Rhineland-Westphalian district nearly ¾ is from coal, and nearly ¼ from gas, other fuels and water-power hardly being used at all. In Saxony and Brandenburg nearly the whole production is from coal, principally lignite. In South Germany, about ⅓ is from fuel and ⅔ from water. And in the rest of Germany, about 90 per cent. is from fuel and 10 per cent. from water. About half of the total production is by public utility undertakings. See *Aufbau und Entwicklungsmöglichkeiten der europäischen Elektrizitätswirtschaft*, published by Schwarz, Goldschmidt & Co., Bankers, Berlin, 1928.

'power' (under which is included heating). The *lighting* demand is composed of several elements, chief among which are: (i) the ordinary domestic lighting demand; (ii) the ordinary business and industrial lighting demand; (iii) the demand for advertisement and shop-window display lighting; and (iv) the demand for street- and staircase-lighting. The demands for ordinary domestic and street lighting are fairly elastic because gas is still a potential or actual competitor in many cases. The other demands are less elastic because gas has practically ceased to compete in these fields and there are no other substitutes worthy of consideration.

The *power* demand has equally varied sources, the chief of them being: (i) the domestic demand; (ii) the industrial demand (including the demands of electric tramways and railways); (iii) the business demand; and (iv) stand-by or breakdown demands. The *domestic* demand, like that for gas, is very elastic over the whole field of customers although it may be quite inelastic for consumers who have installed the necessary apparatus. The domestic demand is for two quite different kinds of consumption. The first kind is consumption in electric fires, cooking-stoves, boilers, flat-irons, coppers, &c., i.e. for consumption that performs work that used to be done by gas, coal, coke, or oil, and may still be done by them. In such cases the competition of substitutes makes the demand relatively inelastic. An explanation of the essential characteristics of such demands and of the fact that the competition is not merely a matter of relative prices was given in a preceding chapter.[1] Another kind of consumption meets with little or no competition from substitutes, because it satisfies demands that did not exist until the electricity industry created them and which are capable of direct satisfaction by electricity only. Examples are: consumption in electric hair-dryers, electrically-heated cushions, and electro-medical apparatus. Such demands are relatively inelastic once the public has been educated up to a realization of its needs for the new services. But even in such cases, electricity has to meet with indirect competition, i.e. it has to compete with the means of obtaining equivalent if not identical satisfactions to those which it provides. The *industrial* demand may be elastic or inelastic according to the possibilities of substituting other forms of energy for electricity, and according to the proportion which the cost of electricitv bears to other costs, in the individual industries.

---

[1] See p. 113.

It is important to note that the industrial demand is not merely for power in the strict sense of the word. There exist also the important and relatively inelastic demands of the electro-chemical industries. The *business* demand (in which the proportion of electrical power is very small compared with that of lighting) is usually very inelastic because of the high value placed upon electricity in such uses for its own sake. *Stand-by* supplies are essentially a matter of 'the insurance of private plants against entire stoppage of the supply of electric energy in case of accident'.[1] Since the value of this service to the consumer is usually very high in proportion to the amount of current actually taken, and since there is no question of direct substitutes in such cases, the demand for stand-by supplies is usually very inelastic.

There is one aspect in which the consumption of electricity resembles that of water rather than that of gas, in that it is not possible for the undertaking to be reasonably sure about the use to which the commodity will be put after it has supplied it. 'No method of classification can deal successfully with the different uses of a lamp socket from which the lamp is from time to time removed to be replaced by an electric flat-iron connection, presumably used for ironing, but which is also demonstrably practicable as a cooker, and which—if the present generation slept in unheated rooms—would doubtless be found superior (though to be used with care) to any of the bedwarmers our grandmothers used. The same lamp socket may also be used to run an electric fan, a washing machine, or a vacuum cleaner.'[2] Undertakings endeavour to bind customers down to specific sorts of consumption both by adopting designs for plugs, sockets, and connexions which make them non-interchangeable, and by legal restrictions. But such devices are never completely successful, and most undertakings are beginning to realize that the interchangeability of at least domestic apparatus must be accepted as an unavoidable obstacle to extensive differentiation between uses.

As with all commodities, an inelastic demand will, *ceteris paribus*, lead to greater possibilities of differentiation than will an elastic demand.

Each of the types of demand mentioned above contributes a different sort of factor to the general load curve of an undertaking. The *lighting* demand is usually responsible for a sharper peak than the power demand, but the different lighting demands vary among themselves, some being more beneficial to the general load-curve than others. The ordinary domestic lighting demand will be very similar to that for gas, i.e. it will be heavier in the winter than in the summer, fairly evenly distributed over the days of the week, and very unevenly distributed over the hours of the day, being practically restricted to a few evening hours in the summer and to a larger number of evening hours and a few morning hours in the winter. The business and industrial demand for lighting will in general be chiefly a winter demand, since most business houses and factories are closed during the hours of darkness in the summer. There are, however, some business and factory buildings which are so built as to require artificial lighting all day long. These of course exercise quite a different effect from the normal on the load-curve, and one that is more welcome to the undertakings. There are also certain industrial and business undertakings which work day and night and which therefore require lighting all the year round during the ordinary off-peak periods as well as during the peaks. An even better influence on the load-curve is exerted by demands for current during the night only. Certain kinds of display and advertisement lighting are of this nature, and consequently are usually welcomed by electricity undertakings with a special tariff.

---

[1] Watkins, *Electrical Rates*, p. 42.

[2] Ibid., p. 112.

Some lighting consumption occurs with such regularity that it is not always necessary to fit a meter for measuring it. Such is the consumption for street-lighting and for staircase-lighting. Under a system of staircase-lighting which is a special feature of German electricity supply, the lighting is automatically switched on at sunset, or at a stated time before or after sunset, and automatically extinguished at 10 or 11 or some other desired hour. An alternative arrangement, sometimes combined with the above, does not provide for continuous lighting, but allows the lights to be switched on during certain periods and automatically extinguishes them after the lapse of one or two minutes. Under the first system, the consumption of a given installation can be calculated almost as accurately as it could be read from a meter; and under the second the possible accuracy of estimate is sufficiently great to allow meters to be dispensed with. The chief advantage of the method is experienced in apartment houses, where it would be inconvenient to share out charges based on meter readings but where the fixed annual sum can easily be included in the rent or otherwise contracted for beforehand. The staircase load is not of the first order of importance. Of greater importance is the street-lighting load, partly because of its similar predictability and freedom from liability to sudden fluctuations, still more because of its extension well into the off-peak hours of the night.

An illustration of the effects of different lighting loads may be seen in the idealized diagrams on p. 144.

Of the *power* loads the industrial demand usually bulks largest, and is responsible for creating the largest fluctuations in the general load-curve. Unfortunately for most undertakings the combined industrial load sometimes remains at or near its peak until about 5 o'clock in the afternoon, and thus overlaps the heavy lighting demand in the winter, the two together creating the main peak of the day. The industrial demand for traction purposes has a tendency in most big cities to reach its peaks at both ends of the working day and during the midday interval and thus, even more than the manufacturing load, tends to increase the winter evening peak. The domestic power demand is much more satisfactory as regards its influence on the general load-curve of an undertaking. The use of much domestic apparatus occurs during the morning, and there is no well-marked peak at any time of the day in the demand, although such peaks tend to develop during the morning and early evening where the cooking demand is increasing. Certain domestic apparatus, notably certain types of water-heater with heat insulation and thermostatic control, can be so regulated as to consume current during off-peak hours only and yet give a constant supply of hot water. Such consumption is naturally of great value to electricity undertakings as improving the general load-curve, and many German undertakings are devoting much attention to the introduction of this kind of apparatus. The business demand varies very much according to the type of business. Some businesses, such as cafés and dance-halls, have a large evening lighting load but a comparatively low power load, which comes very often at the 'wrong' time, i.e. during peak hours. There is a fairly large power demand from hotel kitchens and the like, which usually reaches peaks during the morning and early evening. The bakery demand is still better from the load-curve point of view, being largely restricted to the night hours when the general curve is lowest. This accounts for the very low prices which are often charged to bakeries. Other business demands, such as that

DIAGRAM XXXIII. DAILY LIGHTING LOAD-CURVE OF TYPICAL ELECTRICITY UNDERTAKING

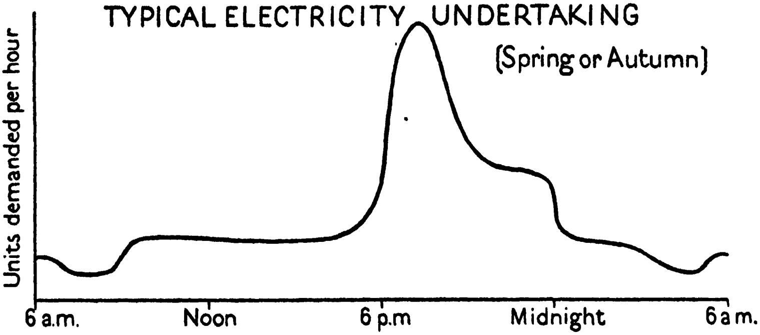


DIAGRAM XXXIV. WEEKLY LIGHTING LOAD-CURVE OF TYPICAL ELECTRICITY UNDERTAKING

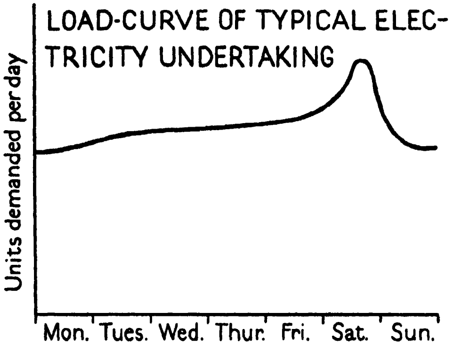
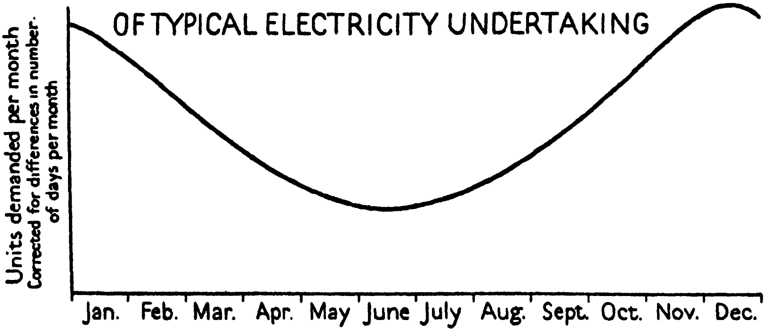


DIAGRAM XXXV. ANNUAL LIGHTING LOAD-CURVE OF TYPICAL ELECTRICITY UNDERTAKING



for lifts, are of a very fluctuating nature as regards individual establishments but of a very steady nature within certain hours over the whole field of supply.

For some classes of demand the undertaking is able to persuade the consumer to undertake the expensive task of storing. This is usually done by the offer of especially low prices for current used for charging accumulators within off-peak periods. Such a procedure is normally too expensive for the consumer; if it were worth while for him in general, it would also be worth while for the undertaking. But there are certain cases in which it is a convenience for the consumer to use accumulators, apart from considerations of cost. This is particularly true of the use of electric power for traction purposes. In such cases the convenience of the accumulators and the low cost of charging them are advantages to the consumer which may well combine to outweigh the incidental disadvantages.

Some industrial undertakings generate their own electricity, relying on the public utility undertaking only in cases of breakdown or unusually high demand. In satisfying such a demand a very high proportion of overhead costs is incurred (the so-called 'readiness-to-serve costs')—indeed, *all* the costs may be overhead, if the breakdown supply is never actually requisitioned—and if discrimination is to be avoided these overhead costs should be paid for by the 'consumer' whether he actually takes any current or not. This could be arranged for without any special grouping of customers by means of a two-part tariff in which the first element was a fixed charge which covered the overhead costs. But in practice only part of the overhead costs are usually so covered, the rest being met by putting stand-by consumers in a class by themselves which is subject to a special tariff.

Typical power load-curves are shown in the diagrams on p. 146.

(*d*) *Conditions of Storage.*

The cost of storing electricity in large quantities is practically prohibitive. A certain small percentage of the output of undertakings is 'stored' in accumulators to provide for the most urgent needs in case of breakdown, but the storage of more than a very small amount in this way is unthinkable. 'In this lies a fundamental difference from the otherwise very similar case of water-supply. In both cases the undertaking has to see to it that the

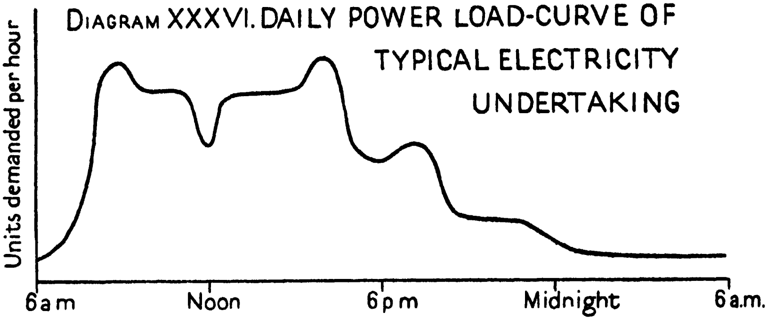


DIAGRAM XXXVI. DAILY POWER LOAD-CURVE OF TYPICAL ELECTRICITY UNDERTAKING

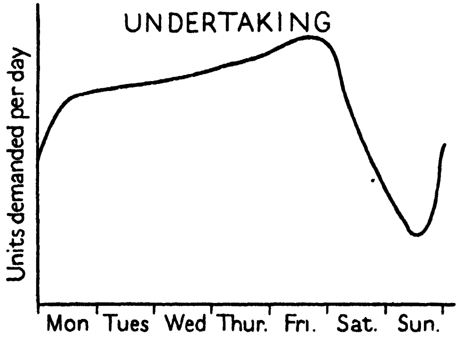


DIAGRAM XXXVII. WEEKLY POWER LOAD-CURVE OF TYPICAL ELECTRICITY UNDERTAKING

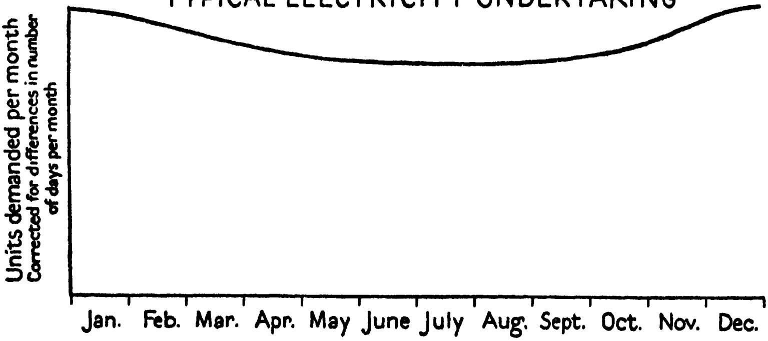


DIAGRAM XXXVIII. ANNUAL POWER LOAD-CURVE OF TYPICAL ELECTRICITY UNDERTAKING consumer is able to obtain the commodity at any time by a single act—pressing a button or turning a tap. But whereas the water is already in the reservoir or spring or river and needs only to be transported, the quantity of electricity in question must first be brought into existence. This is almost the same as if the amount of water drawn off by a consumer were not compounded out of its elements until the tap was turned.'[1] Electric current must therefore in general be produced at the very moment when it is demanded. But demand, as has already been pointed out, fluctuates very considerably over the day, week, and year, rising at times to peaks which are much higher than the average demand. This 'practically necessitates the installation of sufficient generating plant to meet the maximum demand for current, which will occur at one particular hour in the year, probably between 5 and 6 o'clock in the evening on some day in December. Actually the capacity of the plant must be something greater than the maximum demand, to allow of a margin being held in reserve.'[2] But for the rest of the year, and especially during the hours of the night and early morning, a large part of this plant must be idle. The cost of installing and maintaining it in running order would not be materially increased if it were kept running almost continuously throughout the year. The greater the number of hours during which it is not running therefore, the greater must the average charge per unit be. This fact causes electricity undertakings to seek to bring about as steady a rate of consumption as is possible, either through advertisement of and instruction in the use of such apparatus as uses current during the 'valley' periods, or more or less directly through the tariffs.

Sometimes terminology is employed which suggests that the aim of a tariff policy should be to discourage the use of electricity during peak hours and to encourage its use at other times. The latter half of this statement is true enough; but obviously no undertaking would desire to discourage a paying peak demand, however sharp the peak might be, provided that the undertaking was able to satisfy it. To *shift* some of the components of a peak demand to another place on the load-curve does not in the least help to solve the problem of unused capacity. The overhead cost still continues

---

[1] Dr. F. Rumpf: 'Der Elektrizitätsversorgungsvertrag', in *Elektrizitätswirtschaft*, Berlin, 1929, p. 150 n.

[2] Knoop, op. cit., p. 222.

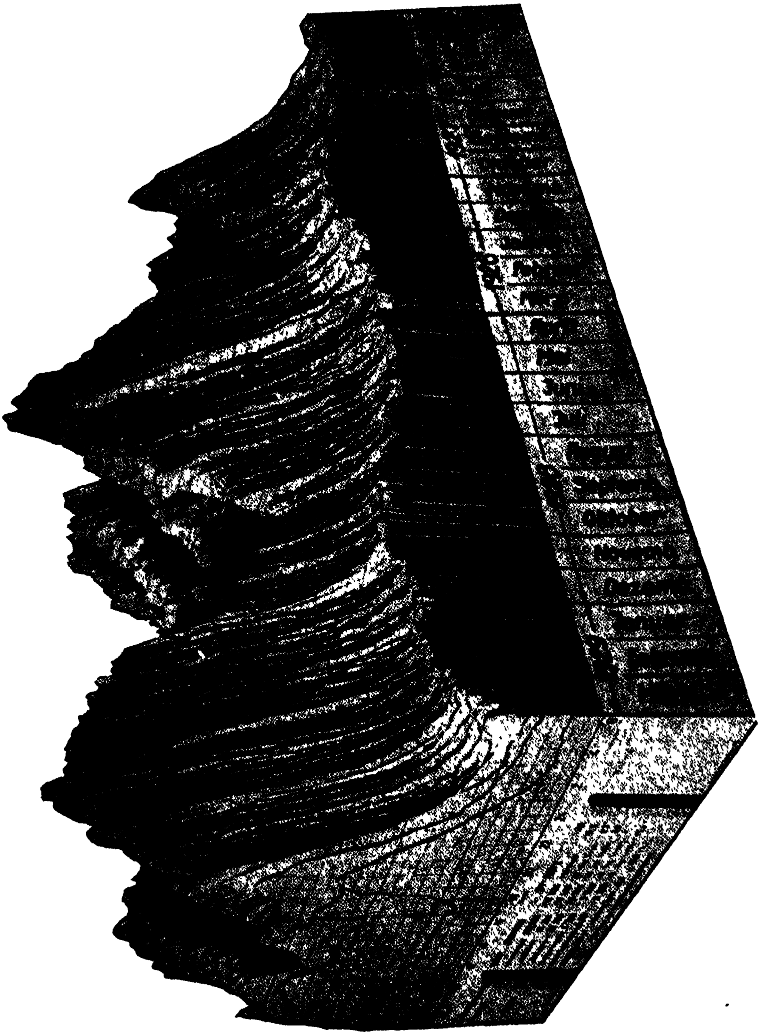
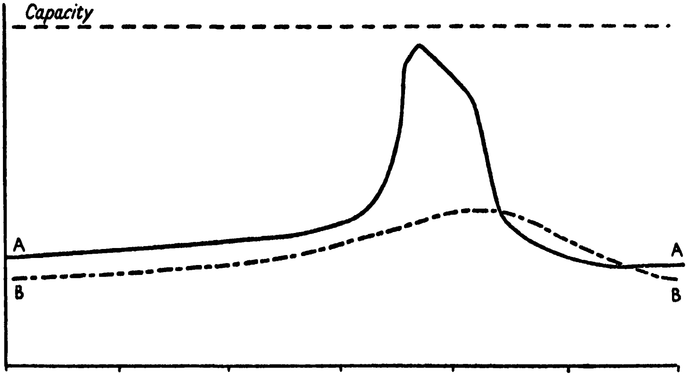


Diagram XXXIX. Model showing variations in load on a central electricity station. Reproduced by kind permission of the Grosskraftwerk, Stettin, A.G.

and the units among which it is to be divided still remain the same. It is the capacity factor which is of prime importance to the undertaking, and the shape of the load-curve is important only in so far as it affects the capacity factor. With certain comparatively unimportant reservations, it is true to say that the shape of the load-curve does not matter at all so long as the capacity factor remains constant. Some badly peaked curves may be preferable to some perfectly smooth and level ones. Thus, in the diagram below, the curve *AA*, despite its bad shape, gives a better capacity factor and is therefore probably more satisfactory for the undertaking than the much smoother curve *BB* which gives the better load factor.

DIAGRAM XL. IDEALISED LOAD-CURVES



It was stated that this rule is subject to certain minor modifications. One of these is that the above argument is merely static, and that dynamic considerations introduce other factors. An undertaking might well consider a curve of the shape of *BB* in the above figure preferable to one of the shape of *AA* on the ground that the smoother curve leaves room for meeting additional demands at any point of the curve, whereas the peaked curve admits of no expansion or very little expansion at certain points.

This matter would seem to be sufficiently obvious not to require mention, but references to the 'discouragement' of peak demands are so frequently met with, and so even are actual tariffs obviously designed to cause the transference of certain demands from peak to off-peak periods without evoking a compensatory demand, that the matter seems to call for some notice. If peak demands are to be discouraged the discouragement should in general be *relative* only, if it is possible to translate such an idea into concrete terms. The aim of a tariff policy with regard to the load-curve should be to make valleys straight rather than to remove mountains.

(*e*) *Area of Supply.*

Recent technical improvements in methods of distributing current have brought about attempts in all countries with a high degree of 'electrical civilization' to combine small local units into large units, with generating centres situated at great distances from some of the points of consumption. The German electrical industry in particular seems to have adopted as a motto the advice of Goethe: *Immer strebe zum Ganzen! und, kannst Du selber kein Ganzes werden, als dienendes Glied schliess' an ein Ganzes Dich an!* The development, which is being assisted in some countries by deliberate legislative action, is occurring in Germany by means of the spontaneous growth of holding companies and other amalgamations within the industry, the State itself participating as an ordinary shareholder. All of this naturally raises important problems concerning the differentiation of prices between different areas served by a single undertaking, which are analogous to those raised by the 'Ferngas' developments. Some undertakings with wide areas of supply have a standard tariff system for the whole area, thus ignoring the fact that certain—but not all—costs of transmission are prime costs of the supply to given areas. Other undertakings charge different prices to consumers in different districts, but the differences seldom correspond exactly to costs of transmission. Since these giant undertakings are seldom purely municipal, the question ceases to have the local political aspect that it bears in the water-supply industry, and becomes rather an ordinary problem of differentiation, or of discrimination, on a geographical scale beyond the previous experience of local utilities but not of railways.

The increased possibilities of transmission of current have increased the bargaining power of some consuming districts by giving them a choice between two or more sources of supply. In 1912 this fact had already begun to influence tariffs, and was commented upon by Professor Knoop in the following passage: 'The system of charging higher prices outside than inside the boundaries of a local authority which engages in a trading enterprise, appears to be much less common in the case of electric current than in the case of gas or water. This is probably due to the fact that the small outside areas are in a stronger position in the case of current than where gas or water is concerned; it is comparatively easy to commence operations on their own account, or to obtain a supply in bulk from a power and supply company, or if they are willing, to allow the undertaking to be entirely in the hands of a company. Consequently a large town desirous of supplying outside areas with current will generally have to offer terms as favourable as it gives to its own ratepayers.'[1]

Nevertheless, this development can work both ways. The growth of the practice of supplying large areas from single stations certainly tends to increase competition on the one hand, in so far as a place wanting a supply can choose from stations over a wider area; but at the same time it tends to decrease competition, since there are likely to be fewer stations in the wider area than there were before in the small one. This is true quite apart from any question of legislatively-established monopoly such as the 1926 Act has introduced into the British situation.

II. SOCIAL CHARACTERISTICS

(a) *Importance to the Community.*

All the arguments from social grounds that apply to the encouragement of consumption of gas apply with equal or greater force to the encouragement of that of electricity, although recent newspaper controversy has drawn attention to the fact that there are two sides to the 'smoke-nuisance' question and that the diffused hygienic gain of a large electricity-using city may be off-set by the concentrated loss of the unhappy dwellers in the vicinity of the generating station. Perhaps the benefits of electric lighting for the public eyesight are also somewhat problematic. Otherwise, the official connexion of electricity with hygiene seems to be justified.

Many German cities are at present engaging in campaigns for the introduction of electricity into every house in their districts, not only for lighting but also for cooking, heating, and other purposes. Whether this is in part a matter of business—the business, that is to say, of securing greater profits from the municipal electricity works—or whether the motives are purely 'social', it is impossible to say. But at the least social considerations have a great deal to do with the matter. A particularly interesting case is that of the large blocks of dwellings which many German cities have built since the War as a contribution to the solution of the housing problem. Some of these dwellings are so planned that the use of coal in them for any purpose whatever is out of the question. Many of the cities, for directly hygienic reasons, have insisted that all such dwellings, even those with only one principal room, shall be provided with a bathroom, and here again the question has been practically decided in favour of electricity. Further, most of these blocks of dwellings are provided with common laundries, and this necessitates the provision of some means for washing and drying clothes that will permit of self-contained operation, quick preparation and clearing-up, and payment by individual users on a reasonable basis. All these considerations have again pointed to the use of electricity. Thus the very existence of this kind of scheme depends on the wide use of electricity and this greatly magnifies its social importance. But electricity, although cheap for lighting purposes, has a tendency to be expensive for heating and cooking, and any successful attempt to introduce it for these uses into the homes of the poorer classes usually involves a certain amount of discrimination. The necessity for this is enhanced by the expensive nature of the fittings and apparatus required, which, whether they are bought by the consumer or hired by him from the company or lent to him by the company 'free of charge', are a serious item of customer cost.

---

[1] Knoop, op. cit., p. 235.

(*b*) *Consumption by the Community.*

The chief general public use of electricity is for street lighting, for which purpose it has widely taken the place of gas. The use of it for heating and lighting municipal offices is much less important. Where the tramway undertaking is operated by the local authority and receives current from the authority's own electricity undertaking, the situation is the same in essence, although complicated by an additional factor—the balance sheet of the tramway undertaking. It would be quite easy for one of such a pair of undertakings to subsidize the other, and it would be difficult to detect or prove the existence of such a subsidy. In general, what was said on the subject of charging for communal water supplies is applicable to this subject also.

FURTHER READING ON CHAPTER VIII

KNOOP, D.: *Principles and Methods of Municipal Trading.* (See note on Chap. IV.) Special reference should be made to pp. 222-36.

SIEGEL, G.: *Der Verkauf elektrischer Arbeit.* Julius Springer, Berlin, 1917, pp. viii + 398.

This is the standard German work on electricity tariffs, being a revised edition of *Die Preisstellung beim Verkaufe elektrischer Energie*, 1906. It consists of (i) a study of supply and demand factors, (ii) a survey of the various types of tariff scheme, including notes on the tariffs in use in most important European countries and the U.S.A.; and it contains 27 diagrams, 18 tables, and a valuable bibliography of writings in German, English, and French. Part I should be specially referred to in connexion with the present chapter.

WATKINS, G. P. *Electrical Rates.* Van Nostrand, New York, 1921, pp. 228.

This is an excellent comprehensive survey of electricity price-making considered as a problem of applied economics. Special reference should be made to Chap. I, on 'The Peculiar Interest and Importance of Electrical Rates'.

CHAPTER IX

ELECTRICITY-SUPPLY: CHARGES

'It must be recognized that the electrical rate question is a matter of law and of politics—in no necessarily bad sense—as well as of economics',[1] and its social and economic aspects are seldom harmonious. And even apart from social considerations, the framing of the ideal electricity tariff is practically beyond the scope of human ingenuity, for the economic conditions to which it would have to conform are unusually complex. The natural result of this state of affairs in an experimenting and fallible world is that the electricity-supply industry comes second only to the railway industry in the number and variety of methods of charging in which it rejoices.

It was seen that with water-supply undertakings the question of the load factor is of little importance, since the ease and comparative cheapness of storage permit production to be adjusted to demand without leaving an undue amount of capacity unused. Water undertakings thus have little incentive to smooth out the demand for their product, except perhaps seasonally. Any attempt at seasonal smoothing by means of differential charging would take the form of charging higher prices for summer consumption, either directly, by charging a higher price per gallon in the summer to all consumers, or indirectly, by dividing customers into groups and charging higher prices to those groups which usually used most water in the summer.

As a matter of fact, this practice was seen to be little followed, probably because social considerations render undesirable any measure that would restrict the use of water in summer, at least for domestic purposes. Indeed, throughout the water-supply industry on its domestic side, social considerations usually outweigh economic considerations whenever the two come into conflict, a state of affairs which is largely responsible for and in its turn made possible by the high degree of municipalization of the industry.

In the gas industry, as was shown in Chapter VI, although storage plays a much less prominent part in the economics of undertakings, and purely businesslike considerations a much larger part, the motive for improving the load factor is still weak. For it is, after all, the hourly fluctuations in demand that are generally largest in public utilities, and these the gas no less than the water industry is able to meet by storage. Gas and water undertakings have therefore little incentive for charging less for supplies given at one time of the day than for supplies given at another time, and the overhead costs of such undertakings are usually divided equally among all units sold to customers of the same class.

---

[1] Watkins, *Electrical Rates*, p. 217.

It is true that the overhead costs just referred to are, strictly speaking, those which have to do with generating or catchment and filtering plant alone. Other overhead costs, incurred on account of distributing plant, or the storage works themselves, are usually increased by every additional fluctuation of demand, because the plant for which they are incurred can be constantly utilized to full capacity only if demand is invariable. Other overhead costs are incurred for the business side of an undertaking, which has an almost unlimited capacity for dealing with certain kinds of additional consumption, viz. increases in the individual consumption of customers, the number and kind of their installations remaining constant. But some of these costs, the so-called 'customer costs', although properly regarded as overhead for separate units of commodity, may also be regarded as prime for each customer's total consumption considered as one item of business. Such costs may therefore be allocated to consumers directly and need not be divided among units of commodity. This is, or should be, the basis of the two-part tariff. The overhead costs that remain as non-allocatable even among customers and are not rendered ineffective by means of storage devices—e.g. costs of distribution mains, storage, company promotion—are sufficiently small in proportion to other costs to allow gas and water undertakings to divide them on some entirely arbitrary basis without losing thereby more than they gain. In other words, it does not pay gas and water undertakings to try to persuade their customers to demand collectively at a steady rate throughout the day, except so far as ordinary two-part tariffs incidentally persuade them to do this.

With electricity undertakings the case is different. The impracticability of storage makes an unfluctuating demand highly desirable for the undertaking, and all but the smallest undertakings endeavour to secure additional custom for the periods when their plant is not fully occupied. If differentiation of prices is used as a means to this end, it may be of a direct nature, as when special terms are offered for all off-peak consumption, or of an indirect nature, as when special tariffs are offered for classes of consumption which are on the whole more off-peak than the average. Both kinds of differentiation are practised by most of the undertakings in the twenty-eight largest towns in Germany.

I. CLASSIFICATION OF CUSTOMERS

The oldest and most fundamental customer classification in the electricity industry is that between consumers of current for lighting and consumers of current for power. Until very recent years the desirability of granting low rates to power consumers was an almost unchallenged article of faith of the industry, and Professor Knoop in 1912 treated those cases in which the distinction was not made as quite exceptional. The principal reason for the practice at the time of its inception appears to have been the desire to improve load factors. Electricity was used chiefly for lighting when the industry was first established and consequently undertakings had then to reckon with large peaks and poor load factors. In such circumstances the power demand was welcomed as a means of filling the day-time valleys, even though it could only be secured by the offer of lower rates than lighting consumers were prepared to pay. Two explanations of the power discount, often regarded as contradictory, would therefore appear to be equally and complementarily true: it paid the undertakings to secure the off-peak business, even at a low rate, and the off-peak business could not be obtained unless the lower rate were granted.

It is doubtful, however, at least 'in large cities under developed conditions of electricity supply',[1] if power supplies still fulfil the function of improving the smoothness of load curves. 'The winter peak in large population centers is not due to lighting for residence purposes but rather to the superposition of lighting for commercial purposes upon power uses, in which combination lighting is becoming the lesser constituent.'[2] In such cases the daily load factor would be improved if the power demand were restricted.

Of course, the daily load factor is not the only one that has to be considered, and perhaps weekly and annual curves are more often than not improved by power demands. But even if this provides a case for a certain differentiation of prices, it does not follow that customer classification is necessarily the best method of achieving the desired end. So long as the object in view is merely the encouragement of off-peak consumption, it could be achieved most directly and effectively by means of a single tariff with special discounts applicable to off-peak consumption as such.

---

[1] Watkins, *Electrical Rates*, p. 109.

[2] Ibid., p. 140.

But this is not to condemn power rates altogether. Even if power consumers took current at precisely the same times and to precisely the same extent as lighting consumers, undertakings might still wish to differentiate in their favour if their custom could be obtained on no other terms. Such differentiation would, of course, be discrimination in the broader sense but in the present state of public opinion apparently not in the narrower sense. Such discrimination is economically justified so long as the power rates are high enough to cover all the costs directly attributable to the power supply, and the remaining rates high enough to cover all the remaining costs. But two points must be borne in mind in the application of this rule. The first, which has already been referred to in general terms in Chapter IV,[1] is that 'the costs directly attributable to the power supply' include not only the ordinarily-so-called variable costs of that supply but also the total costs of any extensions undertaken solely on account of it. The second point is illustrated by the history of the gas industry, in which a similar differentiation of price in favour of non-lighting uses used to be made, until the lighting demand became relatively so small as to be unable to bear the share of overhead costs which the customary differentiation allotted to it. This relative decrease in the lighting load was partly due to a decrease in the demand for gas lighting coupled with an increase in the demand for other uses of gas, and partly due to the more subtle factor that the use of the incandescent type of burner permitted the provision of a given quantity of illumination by a smaller quantity of gas. The relative decrease in the demand for gas lighting was chiefly brought about by the advent of electricity. There is no sufficient reason for supposing that electricity itself is likely to suffer in this way from a further competitor, at least in the near future, and a considerable decline in the relative magnitude of the demand for electric lighting need not therefore be taken into account. But there appears to be scope for considerable improvements in the efficiency of lamps, and if such improvements are made, any given demand for electric lighting will of course give rise to a smaller demand than before for electric

[1] p. 68 n.

current. The fact that the improved lamps would be much cheaper to use would probably cause an increase in the demand for electric lighting which would moderate the decrease in the demand for current; but it would completely cancel it only if the demand for lighting were more elastic than it seems to be at present.

Of the twenty-seven undertakings[1] of the present study, twenty-one make the light-power distinction at least in parts of their tariffs. Those who do not make the distinction are therefore still rather exceptional; and there is no reason to suppose that this would be untrue of the whole German supply industry, although collected statistics are not available to prove or disprove this.[2]

According to an anonymous writer quoted by Mr. G. P. Watkins, 'the power rate was originally started as half the lighting rate',[3] and the table opposite shows that this rule still seems to be followed as a rough guide.

Mr. Watkins has stated that 'aside from the distinctive character of power uses—whose distinctiveness is evidently subject to much qualification, and whose claims, also, are not indisputable—there are no classificatory distinctions in electric rate schedules of constant and enduring importance from the point of view of any decipherable principle'.[4] Whether this statement is true of America or not, it certainly does not apply to Germany. Among the twenty-seven undertakings of the present study, at least five types of special tariff of at least relatively constant and enduring importance are in use, besides ordinary general tariffs. It will be convenient to treat the light-power distinction as a cross-classification of these six types of tariff.

---

[1] Essen and Gelsenkirchen are both supplied with electricity by the same undertaking, the Rheinisch-Westfälische Elektrizitätswerke A.G.

[2] The only reasonably complete statistics of German electricity tariffs are those which are collected by the Vereinigung der Elektrizitätswerke and communicated in strict confidence to its members only. It is regrettable that the Vereinigung does not see its way clear to give these valuable statistics a wider publicity. It is well known that certain of its members have cause to regret past favours of this kind which have resulted in the promulgation by inexpert commentators of completely misleading criticisms on the subject of price-policy. But with all the respect due to such an organization, it may be suggested that even in the electricity industry the best method of ensuring that the truth will prevail is not to seal hermetically the well containing it. It is pleasant to be able to record that the need for this rather obscurantist policy seems to be felt by German undertakings in their collective capacity only; for in every case in which the present author has applied direct to individual undertakings for information, he has been assisted most willingly and courteously.

[3] Watkins, op. cit., p. 107 n.

[4] Ibid., p. 111.

TABLE XXVI

Light and Power Rates for Electricity[a]

Town	BASIC PRICE *Light*	BASIC PRICE *Power*
Altona	50*	20*
Bochum	42	23
Breslau	50	50/26[b]
Chemnitz	50	27
Duisburg	38⅓*	18⅓*
Dortmund (General)	40*	20*
Dortmund (Domestic)	20*[c]	9*[c]
Düsseldorf	42*	19*
Elberfeld	38*	17*
Essen (General)	30*	14*
Essen (Domestic)	15¾*[c]	8*[c]
Frankfort	45	24
Halle	45	25
Hamburg	45	20
Königsberg	50	25
Leipzig	42	24
Kiel	26*	20*
Mannheim	40*	20*
Magdeburg	45†	22†
Munich	45*	17*
Nuremberg	45/15[d]	45/15[d]
Stettin	50	25
Stuttgart	55	25

[a] The prices given are, in pfennigs, those which have to be paid by ordinary small consumers, i.e. where a discount tariff is in use, the figure given represents the price for consumers in the first step or block.

[b] Peak and off-peak prices.

[c] Available only when a certain level of power consumption is reached.

[d] Peak and off-peak prices; but the off-peak periods under the lighting tariff are not so long as those under the power tariff.

* Identical or equivalent meter rents or other standing charges payable under both light and power tariffs.

† Different standing charges payable under light and power tariffs.

Each of the twenty-seven undertakings employs a *general* tariff, by which is meant a tariff by which all ordinary consumers are at liberty to be charged if they so desire. Five undertakings make no distinction between light and power uses in their general tariffs, eighteen employ general tariffs which embody the distinction, and four offer both sorts of tariff to their customers as alternatives. In some cases, the general tariff is the only one available to small consumers; in others, it is the only one available to non-domestic consumers; and in others, it forms merely an alternative for those domestic or industrial consumers who are dissatisfied with the special tariff properly applicable to themselves.

Of the special tariffs, perhaps the most interesting are those for *domestic* consumers. Twenty-five such tariffs are employed by nineteen of the twenty-seven undertakings, fourteen of them without distinction between light and power uses, one of them with the distinction, and the remaining ten of them for power uses only. The most usual function of the domestic tariff seems indeed to be that of making current cheap enough for use in domestic apparatus without cheapening unduly its use for lighting and without involving the expense of double wiring and metering. This is usually accomplished by charging a high rate for all current consumed up to an amount estimated to represent the lighting demand and a lower rate, corresponding to the power rate, for all additional consumption. This is quite a different matter from the gradations of a step or block tariff, and does not really amount to a 'discount for quantity' at all, but to an indirect distinction between lighting and power uses. It is the method employed in five of the fourteen tariffs referred to above as making no distinction between lighting and power uses, so that if realities and not mere appearances are considered it would be more correct to say that of twenty-five domestic tariffs, nine did not recognize at all, and sixteen recognized in some form or other, the distinction between the use of current for lighting and for other purposes.

Current is usually cheaper under domestic than under general tariffs. The reasons for this appear to be threefold. In the first place, domestic consumption, at least in large cities, is principally off-peak consumption. 'It is important to note that residence lighting comes on only gradually and does not reach its height till the dinner-hour, while commercial lighting comes on full at twilight.'[1] Domestic cooking demands may come at peak periods, but regular cooking by electricity is not only of small extent at present but 'is likely to remain too expensive under any general kilowatt-hour rate that can at present be foreseen'.[2] It is true that 'the combination of the fireless cooker plan with an electric heating element ought to be highly economical of direct cost as well as highly convenient',[3] but the use of this type of appliance has no tendency to increase the peak load of an undertaking. 'Electric cooking is also likely to a considerable extent to constitute a special summer demand. During the day, also, it fits into the noon-hour valley of industrial use or, at breakfast, comes ahead of the industrial demand,'[1] although this last point is less true of Germany than of America. The heating of rooms by electricity is not an economic proposition for most domestic consumers under any ordinary domestic tariff except perhaps occasionally during the warmer half of the year, when it would be entirely beneficial to the undertaking's load factor. 'Other domestic uses naturally come mainly off the peak.'[2] These facts alone would justify the making of a domestic rate which was equivalent to the rate made for other off-peak uses of current.

---

[1] Watkins, op. cit., p. 140.

[2] Ibid., p. 175.

[3] Ibid., loc. cit.

In the second place, the domestic demand is under present conditions very elastic, and this is especially true of power, as distinct from lighting and heating uses. 'Vacuum cleaners, washing machines and wringers, electric fans, and sewing-machine motors are only the more important among the possibilities. . . . Reference to the wattage of such motor and other appliances and to hours' use in comparison with that of ordinary lighting requirements make it evident that their adoption, together with the further spread of incidental heat uses, might easily double or treble the energy taken by residence consumers, among who [*sic*] the only regular use of electricity at present is for lighting.'[3] A reduction of the price of domestic current below the charges for other off-peak current, designed to secure a more proportionate increase of consumption, might be commercially justifiable although amounting to discrimination in the broader sense.

And in the third place, considerations such as have been dealt with on pp. 151–2 sometimes lead to electricity being supplied to some or all domestic consumers at prices below those which would be most profitable to the undertaking, in order that certain social benefits may be secured.

Besides the twenty-five general domestic tariffs, fifteen *special domestic* tariffs are employed in the twenty-seven towns, i.e. fifteen tariffs which are applicable to special types of domestic consumption only. In Stuttgart and Magdeburg special tariffs are employed for current taken through slot-meters in wash-houses which are used by more than one family. This is obviously a mere matter of convenience. In Munich a special tariff is available for current used in dwellings with not more than two main rooms. The motive here seems to be chiefly social. And in Cologne, Bremen, Halle, Munich, Kiel, Nuremberg, Magdeburg, and Stuttgart, as a matter chiefly of convenience again, special tariffs not involving the use of meters are employed for certain types of small domestic consumption.[1] But the use of this kind of tariff for this purpose appears to be slowly dying out.

---

[1] Ibid., loc. cit.
[2] Ibid., p. 141.
[3] Ibid., p. 177.

---

[1] e.g. in Munich door-bells are supplied with current at the cost of 5 kwh. according to the lighting tariff per quarter. Electric irons in private households are supplied with current according to the following table:

No. of persons in household	*Charge for each iron of not more than 500 watts*
3	4·9 light kwh. per month
4	5·5 ,, ,, ,, ,,
5	6·5 ,, ,, ,, ,,
6 and more	8·0 ,, ,, ,, ,,

But where laundry work is carried on as a home industry, the number of light kwh. charged for varies according to the wattage of the irons used and the number of assistants employed, as follows:

No. of assistants employed	WATTAGE OF IRONS		
	500	*600*	*800*
0	25	30	40
1–3	42	50	68
more than 3	68	82	110

For lamps in cellars, wash-houses, and the like, the number of light kwh. charged for monthly depends on the wattage or candle-power of the lamps, according to the following scale:

SIZE OF LAMP		*Light units charged for*
C.P.	*Watts*	
10	—	1·5
16	15	2·0
25	25	3·0
32	40	3·0
50	60	4·5

For lamps used for the illumination of house numbers the charge is according to the *power* tariff, however, the estimate for each lamp burning from sunset to sunrise being (15-watt size) 5·5 units and (25-watt size) 9·0 units. In certain

An interesting special tariff of quite another kind is that for current used solely for *advertisement* purposes. This tariff is employed by eleven of the twenty-seven undertakings, and in four cases is available for shop-window lighting also. Current charged under this tariff may usually be taken during certain hours only,[1] and sometimes a minimum annual consumption must be guaranteed.[2] The prices charged are in all cases much lower than those for ordinary lighting, as will appear from the following table:

TABLE XXVII

Advertisement Rates for Electricity[a]

Town	BASIC PRICE	
	Ordinary	*Advertisement*
Barmen	40	25
Bochum	42	b
Duisburg	38⅓*	21*
Düsseldorf	42*	20*
Dresden	45	25
Frankfort	45	35/25[c]
Kiel	26*	X*
Königsberg	50	20
Mannheim	40*	X*
Munich	45†	17†
Stettin	50	b

[a] See p. 159, note a.
[b] No information available.
[c] Peak and off-peak prices.
* Identical or equivalent standing charges.
† Different standing charges.
X Special contracts may be entered into.

special cases the consumption of lamps used for ordinary domestic illumination may be estimated according to the following scale:

Nature of room	SIZE OF LAMP		
	Not greater than 40 watts	*40–60 watts*	*Greater than 60 watts*
Living-rooms, kitchens, guest-rooms permanently occupied, &c.	3 kwh. monthly	4·5 kwh. monthly	By arrangement
Bedrooms, servants' rooms, bathrooms, guest-rooms not permanently occupied, &c.	1·5 kwh. monthly	2·5 kwh. monthly	

---

[1] e.g. in Düsseldorf after business hours until 1 a.m. but not before 7 p.m. In Königsberg from 7 p.m. till 6 a.m. In Frankfort from 8 p.m. till 6 a.m.

[2] e.g. in Frankfort 1000 kwh. In Barmen 500 hours' use of the installation.

The chief reasons for granting special terms for advertisement lighting seem to be (i) that the demand is wholly or chiefly off-peak, and (ii) that it is very regular. A lower price than these considerations alone would justify may sometimes be fixed because the demand for advertisement lighting is very elastic, in comparison with the demand for ordinary interior lighting.

Six tariffs are employed for charging other kinds of *off-peak lighting* consumer, or lighting-and-power consumer. Some of these are available for all consumers who fulfil the required conditions as to time of consumption; others only for specified groups of such consumers, as e.g. public halls with a guaranteed minimum consumption (Kiel), hotels with a similar guaranteed consumption (Duisburg), &c. The same principles seem to regulate these tariffs as those for advertisement lighting.

A common argument against the employment of special off-peak tariffs is that it necessitates the installation either of a time-switch or of a special meter. This, of course, involves the incurring of an extra consumer cost, which should logically be represented in the tariff. If consumers then still find it worth their while to take current under this, rather than under the general lighting tariff, its existence is economically justified.

There is a class of power demands that are similar to the demands for advertisement lighting in that they occur or can without inconvenience be made to occur during off-peak periods only. One group of such *off-peak power* demands has been fostered by undertakings in their encouragement of the domestic use of water heaters from which the supply of current can be cut off by a time-switch during peak hours and yet which, being provided with heat insulation, will supply hot water at any time. Nine undertakings employ special tariffs for consumption in such heaters. Another type of demand that can be limited to off-peak hours is for current for charging accumulators. One of the above nine tariffs applies to such consumption also, and eight separate tariffs are employed for it. The extent of the reductions given is shown in the table opposite.

Some of these special tariffs apply to consumption in accumulators of any sort so long as they are charged only outside specified peak hours. Most of them do not apply to accumulators used for lighting installations—a distinction for which it is hard to see any logical reason apart from a wish to discriminate in favour of power

TABLE XXVIII

Power Rates for Electricity[a]

Town	BASIC CHARGE *Domestic Power Tariff*	 *Heating Tariff*	 *Ordinary Power Tariff*	 *Accumulator Tariff*
Berlin	—	—	20†	8
Breslau	—	—	50/26[b]	26
Dresden	16†	6†	16†	6†
Düsseldorf	10*	6*	—	—
Frankfort	10	8	24	10
Hamburg	20	c	—	—
Kiel	20*	X*	—	—
Königsberg	10†	8	—	—
Leipzig	12†	9†	—	—
Magdeburg	22/8*[b]	6*	22*	8*
Mannheim	—	—	20*	X*
Munich	17*	6*	17*	20*
Nuremberg	—	—	45/15[b]	5
Stuttgart	15	6	25	10

[a] See page 159, note a.

[b] Peak and off-peak charges.

[c] Fixed charge only: 1 pf. per month per watt of installed demand. Current may be taken for eight hours per night.

* Identical or equivalent standing charges.

† Different standing charges.

X Special contracts may be entered into.

users as such. Some of them again are applicable only to accumulators that are used for transport purposes.

Sometimes the special accumulator and heating-current tariffs are open to all users of specified apparatus within the peak periods; sometimes other conditions have to be observed as well—the installation must be of a certain size (Nuremberg, accumulators), the annual consumption must reach a certain level (Stuttgart, accumulators), the whole of the consumer's installation must be fed from the accumulator during peak hours (Munich, accumulators), or the consumer must be taking current for other purposes under other specified tariffs (Leipzig, heaters).

Sometimes the consumer is allowed to take current during peak hours also at the ordinary power price (Stuttgart, heaters), or only as an exceptional concession at an exceptional price (Magdeburg, accumulators). And sometimes consumption during peak hours is not permitted at all.

Where special tariffs are not employed, accumulator current is generally charged under the power tariff; but an exception is commonly made of accumulators used for lighting, for which current is charged at the lighting rate, whenever taken.

In addition to the above, seven tariffs are employed for current used for any power or light-or-power purpose within specified off-peak periods. Some of these are further qualified by requirements as to minimum consumption or minimum installed demand.

General industrial tariffs, i.e. tariffs by which any consumer so long as he is using current for industrial purposes may claim to be charged, are employed in the twenty-seven towns of this study on four occasions, by three undertakings, only. Of these four tariffs, three apply to light and power uses, and one to power uses only. Since even the three light-and-power tariffs are applicable only when current is taken principally for power, these tariffs may be best regarded as variants of the power classification.

Special industrial tariffs, i.e. tariffs by which only certain kinds of industrial consumer may claim to be charged, are employed in twenty-one cases. Sometimes the special limitations refer merely to the regularity of the demand (Barmen, Bochum, R.W.E.). More often the annual consumption must reach an agreed minimum quantity (Breslau), or similar standards must be reached in the matter of installed demand (Hamburg, Halle), or load factor (Cologne), or time of consumption (Chemnitz). Most often of all the special tariffs are available only for scheduled industries, usually without any other conditions. Among industries and other undertakings thus favoured are agriculture (Berlin, Kiel), hotels and cafés (Frankfort, Dresden, Kiel, Mannheim, Breslau), hospitals (Frankfort), bakeries (Dresden, Mannheim), theatres and cinemas (Mannheim, Breslau), shops (Kiel, Breslau), and educational, religious, scientific, and medical institutions (Berlin). Of the twenty-one special industrial tariffs, five are for light uses only, five for power, and eleven for light and power. The desire to meet the competition of substitutes, to stimulate new demands, or to encourage off-peak consumption, usually accounts for the making of special industrial tariffs.

It has already been pointed out that German electricity undertakings have encouraged a demand for a peculiar system of *staircase* *lighting*, the characteristics of which are: (i) its regularity, (ii) its convenience in coming on the whole after peak hours, and (iii) the possibility of being estimated with sufficient accuracy to warrant dispensing with a meter. Special tariffs for this demand are employed by nine of the twenty-seven undertakings.

There are certain other parts of buildings which share with staircases the characteristics of being lighted only intermittently, and of being used by different families. Such are cellars and basements. There is an obvious convenience in bringing such parts of buildings within the scope of the staircase-lighting tariff, as is done in four of the above nine cases.

The total number of tariffs employed in the twenty-seven undertakings is 163. Their applicability to different classes of customer may be seen from the following summary table:

TABLE XXIX

Customer-groups for Electricity Tariffs

	USE		
Customer-group	*Lighting*	*Power*	*Lighting and Power*
General . . .	22	21	9
General Domestic .	1	10	14
Special Domestic. .	5	6	4
Off-peak, Advertisement	11	—	—
Off-peak, Accumulators	—	8	—
Off-peak, Heating .	—	9	—
Off-peak, Other . .	2	3	4
Staircase . . .	9	—	—
General Industrial .	—	1	3
Special Industrial .	5	5	11
Total . . .	55	63	45

It is especially interesting to note that of the 163 tariffs employed altogether, 55 or almost exactly $\frac{1}{3}$ are for lighting consumers only, 63 or a little more than $\frac{1}{3}$ for power consumers only, and 45 or a little less than $\frac{1}{3}$ for both lighting and power consumers. It is also interesting to note that 52 or a little under $\frac{1}{3}$ are available for all consumers without distinction except between lighting and power uses, 40 or a little under $\frac{1}{4}$ for domestic consumers, 37 or a little under $\frac{1}{4}$ for various off-peak consumers, and 25 or a little under $\frac{1}{6}$ for industrial consumers.

Where many forms of tariff are employed it is the combination which makes up a complete tariff-scheme that is significant; single tariffs considered by themselves are almost meaningless. On the average about six tariffs are employed by each of the above twenty-seven undertakings. One undertaking employs 2 only, four employ 3, two employ 4, five employ 5, four employ 6, four employ 7, three employ 8, two 9, one 10, and one 12. The employment of a general tariff, with or without the power-light distinction, is universal. This, together with a special light-and-power industrial tariff and perhaps a tariff for some sort of off-peak consumption, constitutes what we may call the typical small tariff-combination. Such is that of Berlin.[1] The typical medium-sized tariff-combination consists of the above three kinds of tariff with the addition of one or two general domestic tariffs, a tariff for stair-lighting, and perhaps an additional industrial tariff.[2] The typical large tariff-combination consists of general, domestic, industrial, and stair-lighting tariffs, with two, three, four, or even five special off-peak tariffs and/or some special industrial and domestic tariffs.[3]

It has already been argued that classification of customers is best employed only as a *pis aller* when the desired differentiation cannot be secured within the frame of a single tariff. This situation arises only when the differentiation amounts to discrimination in the broader sense.

---

[1] The Berlin tariffs are as follows: 1. *General*: Flat rate (20 pf.) with monthly standing charge from 80 pf. upward according to installed demand. 2. *Special Industrial*: Flat rate (50 pf.). 3. *Off-Peak Accumulator*: Flat rate (8 pf.) with standing charges as in Tariff 1.

[2] A good example is provided by the Frankfort tariffs, which are as follows: 1. *General Light*: Step tariff (45–41 pf.). 2. *Restaurant* (*light*): Double flat rate (Day 40, Night 16). 3. *Hospital* (*light*): Off-peak flat rate (Night 16). 4. *Advertisement* (*light*): Double flat rate (Day 35, Night 25). 5. *Window and Shop* (*light*): Off-peak flat rate (Night 25). 6. *General Power*: Step tariff (24–21 pf.). 7. *Off-Peak Heating*: Flat rate (8 pf.). 8. *Accumulators*: Off-peak flat rate (10 pf.). 9. *Domestic*: Block (45–10 pf.).

[3] The Munich tariffs are typical, viz.: 1. *General Light I*: Step tariff (45–35 pf.) with meter rents (40 pf. per month upwards). 2. *General Light II*: Double tariff (17 pf. up to agreed demand, 45 pf. for all in excess) with standing charge (1·20 RM. monthly per 100 watts of agreed demand). 3. *Domestic I*: Double tariff (17 pf. off-peak, 45 pf. peak) with meter rent (80 pf. per month upwards). 4. *Domestic II*: Tariffs 2 and 3 combined. 5. *Special Domestic* (for dwellings with not more than two principal rooms): Flat rate (35 pf.). 6. *General Power*: Step tariff (17–13 pf.) with meter rents as in Tariff 1. 7. *Accumulator*: Off-peak step tariff (20–12 pf.) with meter rents as in Tariff 3. 8. *Advertisement*: Double tariff (Day 45 pf. flat, Night 17–13 pf. step) with meter rents as in Tariff 3. 9. *Off-Peak Heating*: Double tariff (Day 17, Night 6). 10. *Off-Peak Power*: Discount of 40 per cent. off prices in Tariff 6. 11–12. *Special Domestic Fixed-Charge Tariffs*: See note on page 162. 13. *Stair-Lighting Tariff*: Fixed charges according to nature of installation and service (1–14 kwh. at lighting prices per month). (See page 178.)

Perhaps, judged by this rule, German electricity tariffs are at present too numerous. That the old light-power classification is often unnecessary has been argued on pp. 156–7. For similar reasons, the granting of special terms to consumers of current in accumulators, water heaters, advertising signs, and the like, would often appear to be substitutable by the granting of special terms to off-peak consumers as such, which could be achieved within a single tariff. Differentiation between domestic and industrial uses seems in general to be necessary because of the varying elasticities of demand in the different fields. Similar discrimination may be felt to be necessary between different kinds of industrial consumption. The special lighting rate based on estimated instead of measured consumption has its justification in mere convenience.

Perhaps it is too much to hope with Mr. G. P. Watkins that 'the classification of service will gradually cease to be an important method of electrical rate-making, except possibly in small towns, being otherwise appropriate only for experimental and provisional rates designed to develop, and determine the characteristics of, some one or another kind of new business'.[1] For so long as electricity is of varying efficiency in its various uses, and meets with the competition of different substitutes, and is purchased by people with different incomes, so long will scope exist for improving the capacity factor of undertakings by charging different prices to different consumers for what they regard as substantially the same commodity. And public opinion seems disposed to countenance more and more of this kind of price-policy, at least in Germany.

II. TARIFFS

Classification apart, customers' influences on the general overhead costs of an undertaking, as well as on its customer and prime costs, may be recognized by appropriate types of tariff. Three principal tariff-forms were noticed as being in use in the gas- and water-supply industries in Germany. These forms—one-part, two-part, and fixed charge—together with their sub-varieties based on flat-rate or discount scales are all employed in the electricity-supply industry. But an additional complication is introduced by various methods of differentiating the price according to the time of consumption.

---

[1] Watkins, op. cit., p. 109.

Nothing remains to be said of the relative merits of one- and two-part tariffs beyond what has already been said in Chapters V and VII. Of the 163 tariffs employed in the twenty-seven undertakings, 52 are one-part and 73 two-part. Twenty-two of the *one-part* tariffs are general, 16 'off-peak', 7 domestic, and 7 industrial. Eleven of them are for light-and-power users, 18 for light, and 23 for power. The one-part form cannot be recommended for general tariffs in ordinary circumstances; but it is less objectionable where the general tariff is modified by the employment of alternative subsidiary tariffs, and may be quite unobjectionable for the subsidiary tariffs themselves.

Twenty-seven of the fifty-two one-part tariffs are plain flat rates. Seven of the twenty-seven are complicated by the exaction of a minimum charge whether the flat-rate charge reaches the set minimum or not. This device partly overcomes the chief objection to the flat rate, which is that it ignores customer costs. It is sometimes argued that charging a minimum amount is equivalent to charging a meter rent or other standing charge, and that a one-part tariff with a minimum charge is equivalent to a two-part tariff. It is, however, preferable to regard the one-part tariff with a minimum charge as essentially a one-part tariff which creates its own special class of consumer; for its effect is usually to encourage consumption up to the set limit, rather than to exact payment for consumption which has not taken place.

The remaining twenty-five one-part tariffs are in roughly equal proportions step, block, and mixed tariffs.

The *two-part* form is used chiefly for general (26) and domestic (19) groups of customers. It is also used for off-peak consumers (16) and industrial consumers (12). Twenty-five of the two-part tariffs are for light-and-power users, twenty for light, and twenty-eight for power. It is not insignificant that the excess of two-part over one-part tariffs is almost entirely for light-and-power users.

Forty-eight of the seventy-three two-part tariffs are based on flat rates. This is therefore by far the most important type of electricity tariff in the largest German towns. It is employed chiefly for general and general domestic groups of customers. The remaining twenty-five two-part tariffs are in roughly equal proportions, step, block, and mixed tariffs.

Five tariffs in addition are a mixture of the one-part and two-part forms. There are therefore altogether seventy-eight electricity tariffs in use in the twenty-eight largest German towns which consist in part of a standing charge of one sort or another. Thirty-six of the seventy-eight standing charges take the form of a plain meter rent. The merits of this as an adequate measure of consumer costs have already been discussed on p. 134. A further thirty-three are based either on the consumer's demand (23) or on the size of the premises supplied (10). The remaining nine are compound standing charges, consisting of one or other or both of these forms of standing charge together with a meter rent. The following table gives fuller details of these combinations:

TABLE XXX

Standing Charges in Electricity Tariffs

	NO. OF TARIFFS		
Basis of standing charge	*Without meter rent*	*With uniform meter rent*	*With variable meter rent*
No. of rooms .	7	—	—
Value of property .	—	—	3
Area of property .	1	—	—
No. of rooms or area	2	—	—
No. of rooms + installed demand .	1	—	—
Installed demand .	21	—	2
Maximum demand	2	1	1
Installed demand + maximum demand	—	1	—
—	—	4	32
Total . .	34	6	38

It will be seen that meter rents form part of forty-four of the above tariffs. Two kinds of meter rent may be distinguished, those which are really nothing but the price paid for the loan of a meter and those which are something more. Very few undertakings allow ordinary customers to employ their own meters, 'for despite technical improvements, the electricity meter remains a sensitive instrument requiring maintenance and repair with the passage of time and needing to be constantly inspected by the undertaking. Where meters are in the possession of consumers, disputes between the undertaking and the consumers have been common, so that it has now become the general practice to provide meters on loan conditions only.'[1]

A reasonable meter rent would cover interest charges on the capital cost of the meter together with the costs of such maintenance and repair and insurance as was the responsibility of the undertaking. (The cost of installing or removing a meter is usually charged to the consumer as a single separate sum.) In the opinion of Professor Siegel, such charges would amount to 25 or 30 or in any case not more than 50 pf. per month for the smallest type of meter in common use, and would be proportionately greater for larger meters. The following list of meter rents charged by the twenty-seven undertakings of the present study shows that this level of charges is frequently exceeded, even if allowance is made for differences between the price levels of 1917 and 1930. Where this is the case, the 'meter rent' is really a true meter rent plus another fixed charge.

TABLE XXXI

Meter Rents in Electricity Tariffs

Tariff	*Monthly charge in pf. for* *Ordinary meters*	*Special meters*
Cologne . . .	50†	150†
Dortmund (General).	*	*
Dortmund (Domestic)	42	—
Dresden . . .	400†	—
Duisburg . .	50†	125†
Düsseldorf . .	—	50
Elberfeld. . .	50†	100†
Essen (Domestic) .	50	—
Halle . . .	100†	—
Hamburg (Time switch)	—	100
Königsberg . .	150†	—
Leipzig (Light) .	180†	—
Leipzig (Power) .	162†	—
Mannheim . .	30†	—
Munich (General and Domestic) . .	40†	80†
Munich (Time switch)	—	40

* Information not available.
† Charge for smallest type of meter.

---

[1] Siegel, *Verkauf elektrischer Arbeit*, p. 252.

The case for standing charges has been discussed in Chapters VI and VIII. Here it need only be repeated that the principal object of a standing charge should be to cover consumer costs, and the secondary object to cover such share of the general overhead costs as the undertaking sees fit to allocate in this manner.

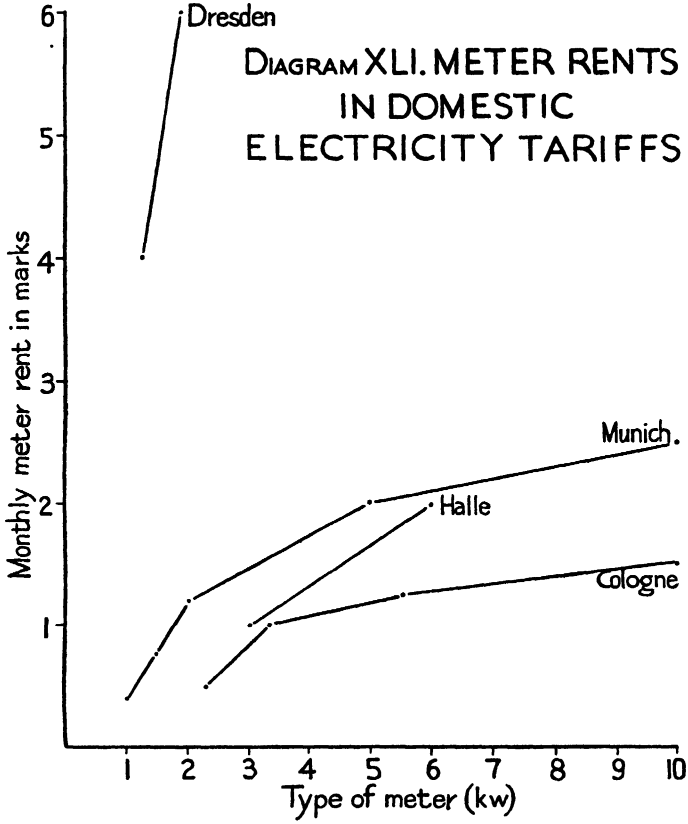


DIAGRAM XLI. METER RENTS IN DOMESTIC ELECTRICITY TARIFFS

A standing charge which is based on the size of the meter is, if the meter is suited to the work it has to do, closely akin to standing charges based on maximum or installed demand. Table XXX shows that installed demand was taken as a complete or partial basis for determining standing charges in twenty-five of the seventy-eight two-part tariffs. The scales of charges made by the undertakings in Berlin,[1] and Magdeburg,[2] are typical.

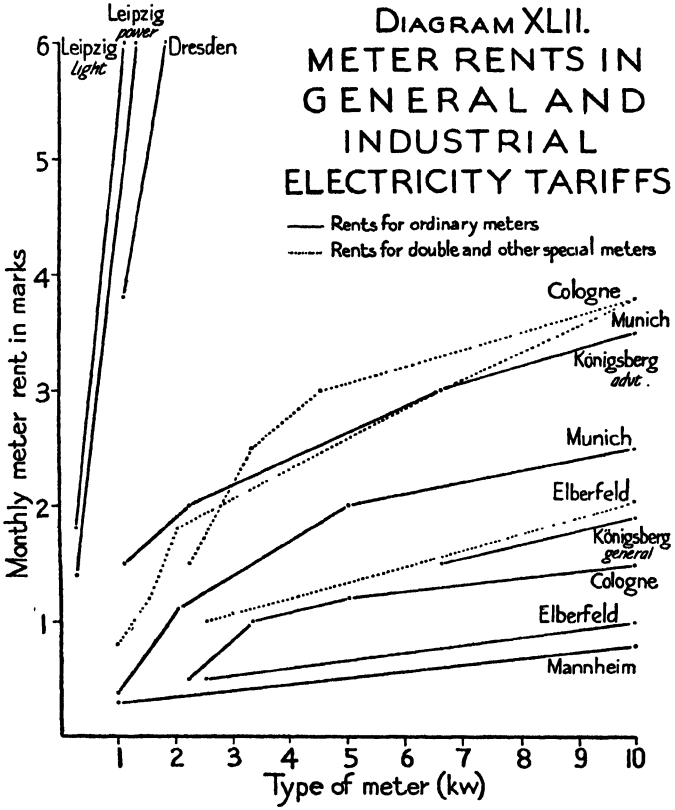


DIAGRAM XLII. METER RENTS IN GENERAL AND INDUSTRIAL ELECTRICITY TARIFFS

---

[1] The Berlin scale is approximately at the rate of 4 pf. per month for each 11 watts of installed demand. But for tariff purposes the installed demand is calculated as follows:

(*a*) Lamps up to 15 and over 60 watts	actual wattage.
(*b*) Lamps between 15 and 60 watts	30 watts each.
(*c*) Domestic apparatus up to 1,500 watts	30 watts.
(*d*) Apparatus used for business purposes	actual wattage.
(*e*) Power installations with maximum demand equal to installed demand	640 watts per 1 H.P.
(*f*) Power installations with maximum demand smaller than installed demand	400 watts per 1 H.P.
(*g*) Lifts	400 watts each.
(*h*) Domestic lighting installations	80 per cent. of the values in (*a*) and (*b*).

[2] For note 2 see facing page.

The merits and demerits of this system have been dealt with on p. 136. A consumer's maximum demand is a better indicator of his responsibility for general overhead costs if not of his consumer costs. But tariffs with standing charges based on maximum demand, Hopkinson tariffs as they are usually called after the London professor who invented them, are charged in five of the above cases only, although they are largely used for charging for high-tension current. A typical employment of the scale for low-tension supplies is that of Hamburg.[1]

For small consumers neither installed demand nor maximum demand are very convenient bases to adopt, the one because it can be ascertained only by frequent inspection and tends to restrict the extension of demand, the other because a special and expensive instrument is needed for its measurement. This may explain the popularity of pseudo meter-rents as the standing-charge element in domestic two-part tariffs, even though it does not escape the difficulty of discouraging consumers from increasing their installations. From many points of view a better basis, for domestic tariffs, is the size of the house to which the supply is given. This has the merit of being relatively fixed, clearly definable, and yet reasonably related to the consumer's maximum possible demand.

[1] The annual standing-charges are as follows:

Maximum demand	*Annual charge in marks*
First 50 kw.	140 per kw.
Further 50 kw.	120
,, 100 kw.	100
,, 100 kw.	90
,, 100 kw.	80
All further kw.	70

[2] The Magdeburg scale is based upon the actual installed demand as follows:

Installed demand in kw.	ANNUAL STANDING CHARGE IN MARKS UNDER				
	Light tariff	*Power tariff*	*Double tariff I*	*Double tariff II*	*Double tariff III*
0–1·5	4·00	2·00	18 per kw.	96 per kw.	144-72 per kw.
Over 1·5	9·60	4·00			
,, 3	18·00	8·00			
,, 6	24·00	15·00			
,, 10	36·00	20·00			
,, 15	54·00	25·00			
,, 20	72·00	36·00			
,, 30	96·00	42·00			

The size-of-house basis, measured in terms of rateable value, gained considerable popularity some years ago as characterizing the so-called Norwich Tariff. German conditions have not permitted the adoption of the rateable-value measurement and alternative and usually better standards have consequently been employed. In Cologne, for example, the standing charges are partly based upon the pre-war rentable value of the property to which a supply is given, in accordance with the following scale:

Pre-war rentable value in marks per annum	*Annual standing charge in marks*
0–600	0
601–700	4
701–800	6
801–1000	8
1001–1200	10
1201–1500	13
1501–1800	16
1801–2100	19
2101–2400	22
2401–2700	25
2701–3000	28
3001–3500	33
3501–4000	38
4001–4500	44
4501–5000	50
Each further 500	6 extra

The chief objections to this basis are (i) that it may be difficult to measure to the satisfaction of both parties, and (ii) that it favours 'low-class' property. A more usual basis, first employed in Potsdam, is the number of rooms. The rooms taken into account are usually only the so-called living rooms, viz. sitting-rooms, drawing-rooms, bedrooms, kitchens, &c., but not bathrooms, sculleries, wash-houses, corridors, landings, or, in many undertakings, dining-rooms. The average charge per room varies in different towns from less than one mark to more than two marks per month, and usually increases with the size of the house, as may be seen from the diagram opposite.

'The particular objection to the number of rooms basis is that it does not discriminate between a house with small rooms and a house with large rooms.'[1] This difficulty is overcome in the Kiel

---

[1] English Electricity Commission, *Report on Uniformity of Charges and Tariffs*, 1930, p. 22.

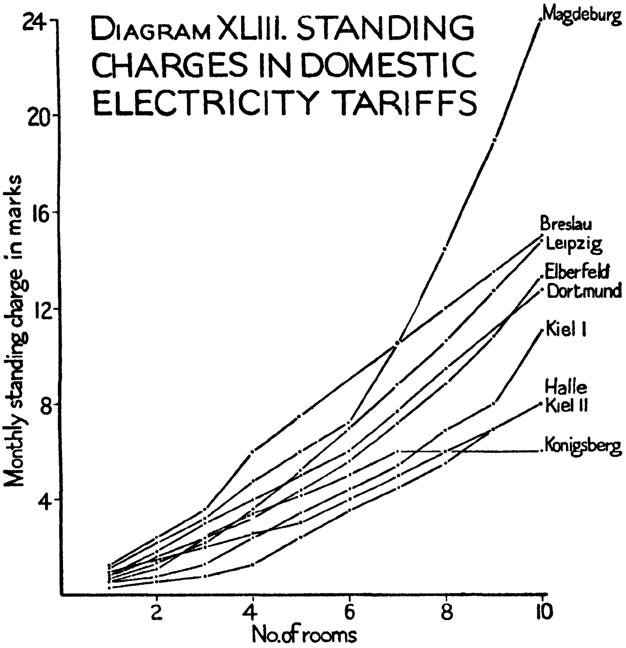


DIAGRAM XLIII. STANDING CHARGES IN DOMESTIC ELECTRICITY TARIFFS

domestic tariff by making the standing charge dependent only in part upon the number of rooms and in part upon their floor area. The full scale is as follows:

No. of rooms	*Total floor area*	*Monthly charge in marks*
1	—	0·35
2	Under 20 sq. m.	0·35
2	20–32	0·50
2	Over 32	0·70
3	Under 48	0·70
3	48 and over	1·50
4	Under 64	1·50
4	64 and over	2·50
5	Under 80	2·50
5	80 and over	3·50
6	Under 96	3·50
6	96 and over	4·50
7	Under 112	4·50
7	112 and over	5·50
8	Under 128	5·50
8	128 and over	7·00
9	Under 144	7·00
9	144 and over	8·00
10	Under 160	8·00
10 and more	—	11·00

Eighteen tariffs are pure *standing-charge tariffs*; that is to say, the total charge does not vary according to consumption, but according to the nature of the installation. Nine of these tariffs are for staircase lighting,[1] four for various kinds of special domestic lighting,[2] and five for domestic apparatus of a non-illuminating nature.[3] The case for charging for staircase and similar kinds of lighting by this sort of tariff seems to be sufficiently strong; that for charging for other kinds of consumption by it seems to be weak, for reasons which have been set out on pp. 105–6. The employment of standing-charge tariffs for such uses is in fact gradually dying out.

In fifteen cases, *special prices* may be quoted for certain classes of consumption although no tariffs of such prices are published.

The tariff-forms dealt with so far have their counterparts in the gas- and water-supply industries. A peculiarity of the electricity-supply industry is the extent to which its tariffs are complicated by provisions relating to the time at which consumption occurs. Sixty-nine of the above 163 tariffs embody such provisions. Thirty-seven of the sixty-nine are applicable only to consumption occur-

---

[1] A good example is provided by the Munich scale, which is as follows:

Type of service	*Size of lamp in watts*	*Estimated monthly consumption when lights are extinguished at*		
		8 p.m.	*9 p.m.*	*10 p.m.*
I. Normal	15	1·5	2·0	2.6
	25	2·0	2·5	3·0
	40	2·5	3·0	3·5
II. Normal, with 3-minute press-button illumination during day-time as well	15	2·5	3·0	3·5
	25	4·0	4·5	5·0
	40	6·0	7·0	7·5
III. Constant illumination from 6.30 p.m. and 3-minute illumination during the night	15	6·0	7·0	8·0
	25	10·0	11·0	12·0
	40	12·0	13·0	14·0

These quantities have to be paid for at the ordinary lighting rate, and in addition a monthly charge of 2 light-kw. for the time-switch. For a description of the types of service see p. 142.

[2] For example see p. 162, note 1.

[3] For examples see p. 162, note 1.

ring within specified off-peak hours. These tariffs have already been dealt with on pp. 163 ff. Two other principal methods of varying price according to time of consumption are employed. The first, employed in twenty-two tariffs, consists in dividing the twenty-four hour day into peak and off-peak periods and charging a different price for consumption within each period.[1] The second, employed in seven tariffs, consists in giving the consumer a discount proportioned to his own load factor.[2] The two methods are combined in three tariffs. As a device for improving the load factor of the undertaking, the double tariff is obviously much superior to the load factor discount tariff. If the 'load factor' discount is based, not on the maximum demand of the consumer but on his *installed* demand (i.e. if it is based on his capacity factor), this method has the advantage over the double tariff of not requiring

---

[1] e.g. in Nuremberg high prices are charged for consumption within the following peak periods:

Month	*Peak period under*	
	Ordinary tariff	*Power tariff*
	p.m. a.m.	p.m. p.m.
January . .	5 to 6	5 to 7
February . .	5·30 ,, 6	5·30 ,, 7
March . .	6 ,, 6	6 ,, 7
April . .	7 ,, 5	No peak periods
May . .	8 ,, 4	
June . .	8 ,, 4	
July . . .	8 ,, 4	
August . .	7 ,, 5	
September .	6 ,, 6	6 ,, 7
October . .	5·30 ,, 6	5·30 ,, 7
November .	5 ,, 6	5 ,, 7
December .	4·30 ,, 6	4·30 ,, 7

[2] e.g. in Mannheim the total annual consumption in kwh. is divided by the installed demand in kw. and discounts given for the 'number of hours use of installation' according to the following scale:

Hours use	*Discount*
Over 300 hrs.	5 per cent.
,, 600 ,,	10 ,,
,, 900 ,,	15 ,,
,, 1,200 ,,	20 ,,
,, 1,500 ,,	25 ,,
,, 1,800 ,,	30 ,,

the employment of a special meter. But this fact would not be important where the consumption was very large, as it is in most of the groups to which the load-factor discount tariff is applied.

Twelve of the above tariffs are qualified by a *coal clause*, which stipulates that the kilowatt-hour charge shall vary from time to time according to the price of coal. Thus in Elberfeld the basic charges for a unit of current are raised by 0·085 pf. (light), 0·35 pf. (power), and 0·12 pf. (double) for every rise of 10 pf. in the price of a ton of coal. Again, the R.W.E. charges are subject to alteration according to the following clause:

> For every x per cent. increase in the price of coal over 15 marks per ton at the pit-mouth, the power price of 14 pf. will be increased by $0{\cdot}6x$ per cent. and the lighting price of 30 pf. by $0{\cdot}55x$ per cent.

This practice is economically justifiable as being in accordance with the principle of charging all costs to the units of product to which they are imputable.

A few words remain to be said concerning two special cases of electricity supply, the tariffs for which have not been dealt with in the preceding pages.

Stand-by Supplies. Most undertakings supply current only on special terms to consumers who either generate their principal supplies themselves or receive them from a third source. Such subsidiary or stand-by supplies are conveniently conceivable as 'having to do chiefly with the insurance of private plants against entire stoppage of the supply of electric energy in case of accident'.[1] Nevertheless, for tariff purposes these supplies must be judged by the same criteria as ordinary supplies, their special peculiarity being merely an unusually small proportion between consumption and installed or maximum demand. Suitable tariffs for stand-by supplies therefore chiefly comprise high standing charges.

High-tension Supplies. The charges for high-tension current are usually much lower than those for ordinary low-tension current. This may be regarded as a fundamental differentiation of prices; but a preferable point of view is to consider high-tension current as 'the crude or incompletely manufactured product'[2] to which a separate price is naturally appropriate; and as a commodity therefore which does not necessarily fall within the scope of the present chapter.

---

[1] Watkins, op. cit., p. 42.

[2] Ibid.

It would nevertheless have been desirable to include a survey of high-tension tariffs within the present study, had it not been that high-tension *tariffs* seldom actually exist. Most undertakings work from a more or less secret high-tension-price formula. In this lies the strength and the weakness of this branch of their business: the strength, inasmuch as such formulae are usually well-planned so as to take account of all the variables of which it is desirable that account should be taken; the weakness, inasmuch as the results derived from the formulae are often so modified by the process of bargaining with large consumers as to rob the formulae of all significance. The effect is sometimes as if each large consumer constituted a separate tariff class. Undoubtedly the industry as a whole, as well as individual undertakings, would greatly benefit if the lead given by some of the foremost undertakings in publishing and adhering to their high-tension tariffs were widely followed. There is, of course, no reason why an undertaking should not employ more than one high-tension tariff, so long as the basis of the differentiation is plain and public.

The ideal electricity tariff-combination, so far as that is approachable in practice, would probably consist of a standard tariff which met all ordinary circumstances and which took account of amount of consumption, time of consumption, and consumer costs, together with a few special tariffs where these were necessary for dealing with consumers (i) whose demand was very elastic (e.g. industrial consumers), (ii) whose demands needed to be stimulated (e.g. at present domestic power consumers), or (iii) whose demands were so small as to make the installation of elaborate apparatus disproportionately expensive (e.g. small domestic consumers). In addition, special tariffs might be required for favouring classes of consumers on grounds other than those of economic principle. In most cases it would probably be desirable for the subsidiary tariffs to take the form of modified versions of the general tariff. This could often be achieved by the alteration of prices, leaving the general scheme untouched; or by the omission of certain elements of the general scheme, leaving the others unchanged.

One fact is quite clear: it is a mistake to assume that there is no room left for further experiment and discovery in this field, or to assume on the other hand that all existing forms of tariff are so unsatisfactory as to render careful consideration of their relative merits a waste of time.[1]

FURTHER READING ON CHAPTER IX

The only source of general information concerning the present charges for electricity in Germany are the tariffs published by the individual undertakings.

SIEGEL, G.: *Der Verkauf elektrischer Arbeit.* (See note on Chap. VIII.)
Special reference should be made to Part II.

WATKINS, G. P. *Electrical Rates.* (See note on Chap. VIII.)
Special reference should be made to Chaps. II—VIII.

---

[1] The task of electricity undertakings in the choice of tariffs would be considerably lightened if the wealth of individual experience could be made generally available, preferably on an international scale. But first steps to this end must obviously be on a national scale. What is required is a complete tabulation of tariff schemes in a standardized form, together with relevant information concerning the undertaking employing them. Of tariff schemes it would be desirable to know how many groups of customers they recognize, what are the distinguishing marks of the groups, and in what way their treatment is differentiated. Of single tariffs, to what classes of customer they apply, whether they are of one- or two-part form, whether the unit-charge is a flat or discount rate, on what principle the discounts are calculated, whether the fixed charge is uniform or not, and if not what are its bases, whether load factor discounts are given and if so in what measure, whether a distinction is made between peak and off-peak consumption and if so what hours are considered as peak hours, whether coal—or other fuel—clauses are embodied, and whether consumers have to guarantee a minimum consumption or load factor. Of the undertakings it would be desirable at least to know their annual output, their load factors, their average costs, and the nature of the principal demands of their customers, much of this information being indeed already available in such countries as Germany and England.

The tabulation and correlation of such information as this would be a very considerable task. Perhaps in England an appropriate government department or even an enterprising trade journal might find it worth while to undertake it. In Germany the appropriate body would seem to be the Vereinigung der Elektrizitätswerke if it could see its way clear to a modification of its present unfortunate policy of keeping the secret of the tariffs as close a secret as possible. But if the task is necessarily a great one, the world-wide benefits to the electricity industry would be immeasurably greater; for there is much to be said for the view that the satisfactory solution of the tariff problem would be of more importance to the industry than any conceivable discoveries in the technological sphere.

CHAPTER X

TRAMWAYS: CHARACTERISTICS

I. ECONOMIC CHARACTERISTICS

(*a*) *Measurement of the Commodity.*

IT is very difficult to measure a service. Passenger-transport services are usually regarded as three-dimensional, or, more correctly, it is generally recognized that passenger fares may properly vary according to three factors—the type of passenger, the distance travelled, and the kind of accommodation provided. Officially different classes of accommodation are no longer provided on German tramways systems, although the actual comfort, speed, and convenience of any tramway service are necessarily greater at some times of the day than at others. For practical purposes, a unit of tramway service is therefore the product of a passenger-unit and a distance-unit. Passengers are usually defined as all persons travelling on the tramway with the exception of children under a certain age who do not occupy separate seats.[1] An apparently convenient unit of distance is the standard long-measure unit of the country; but a method of charge based exactly upon the number of miles or kilometres travelled would be very cumbersome to employ. From 1904 till 1926 the kilometre was the unit of distance adopted on the tramways in Frankfort o. M.; but experience showed that 'such a system is not without its drawbacks, especially if the fare stages are very numerous, and if through tickets are issued from one route to another. The conductors have frequently to refer to elaborate tables showing the distance from every fare stage to practically every other point on the system, in consequence of which delays will often occur in collecting the fares, and a new fare stage may easily be reached before all the fares have been collected.'[2] Fares reckoned in this manner are also rather difficult for passengers to check. To avoid these difficulties, one of three simpler units of distance is usually adopted. These are: (i) the fare stage, (ii) the whole journey made by a single tram, and (iii) the whole journey from any point on the system to any other.

Tramway services do not merely comprise the carriage of persons.

---

[1] In Hamburg and Altona children are carried free of charge if they are not more than 1 metre in height.

[2] Knoop, *Municipal Trading*, pp. 240-1.

But in general the carriage of parcels, dogs, and the like is merely incidental to the main business of carrying passengers and is not in itself of particular interest. Where passengers' luggage is carried free of charge, it is reasonable, however, to suppose that fares will be a little higher than where luggage has to be paid for separately.

(*b*) *Nature of Costs.*

If the passenger-journey or passenger-mile be regarded as the unit of commodity, practically none of the costs of tramway operation are prime costs. The costs specifically attributable to the service of running a single car on one occasion only are chiefly incurred on account of electric current, labour, and wear-and-tear depreciation of car and rails. Those attributable to the provision of a regular service of trams over a single route include in addition interest and other depreciation charges on fixed equipment. And 'the overhead costs' of a whole undertaking include all the above together with the expenses of establishment, management, and inspection. This interesting arrangement of costs, which renders tramway undertakings in many ways the most typical of public utilities, would *ceteris paribus* make extensive differentiation of fares profitable.

A peculiarity of transport services is the nature of their unit of production, which, whatever the *selling* unit may be, is best considered as the complete double or round trip of a single car or combination of cars.[1] This fact is chiefly significant in conjunction with the fact that units of demand are only in the most exceptional cases such as to employ a tram on its whole journey back to the place from which it started. Therefore, unless separate units of demand can be made to fit in with each other, trams must perform part of each double journey with empty seats. This aspect of the problem of unused capacity is peculiar to transport utilities.

(*c*) *Structure of the Market.*

There are five principal groups of tramway passengers in large towns: (i) persons engaged in industry, (ii) persons engaged in business, (iii) school-children, (iv) shoppers, (v) pleasure-seekers. The demands for tramway services of each of these groups are decidedly elastic, largely because of the competition of substitute means of locomotion, of which the most universally available is walking. In wet or very cold weather the lessened attractiveness of walking as a substitute results in a decreased elasticity of the demands of at least three of the above groups. This fact, *per se*, would justify from the economic point of view the charging of heavier fares on wet week-days than on fine ones.

---

[1] In Germany 'trains' of two, three, or four tram-cars are common. The double-decked tram-car is not employed.

The elasticity of a person's demand for tram rides depends not only upon his desire to travel and the availability of alternative ways of doing so, but also upon the size of his income. In general, German public opinion seems disposed to permit a certain amount of differentiation of fares as between people with different incomes, but not as between people with different desires to travel by tram rather than go by other means or not travel at all.

The demands of the above groups fluctuate according to regular daily, weekly, and annual cycles. In a large city, although there may be circular tram routes, the main routes are usually radial. The demand for travel towards the centre usually reaches its peak during the morning, and that for travel towards the periphery in the evening.

On an ordinary week-day the inward movement usually begins at about 6 a.m. with the influx of workers from residential to industrial districts, although in some of the large German cities—Berlin, for example—important industries are situated in the suburbs and the workers live nearer the centre, in which cases of course the usual movement is reversed, the efflux being in the morning and the influx in the evening. The industrial demand is followed by that of other workers and school-children, which normally reaches a maximum between 8 and 9 a.m. A minor influx occurs after the midday interval, and an inward stream of pleasure-seekers in the early evening. The main inward peak of the day usually occurs at about 8 a.m. when the industrial and business demands overlap.

These inward movements have their counterparts in the principal outward movement between 4 and 7 p.m., the smaller movement soon after noon, and the efflux of theatre-goers and others in the late evening.

In addition there are demands which are spread over the morning and afternoon and are for carriage that is neither predominantly inward nor outward in direction. The principal group of passengers with such demands are the shoppers. Their collective demand is a very profitable one to tramway undertakings, since it is not concentrated as to time or district or direction.

On Saturdays the principal outward movements occur at midday instead of in the evening, and the volume and character of the demands of shoppers and pleasure-seekers is modified to occupy the rest of the day. On Sundays and general holidays the pleasure-seekers' demand is the principal one. The week-end and holiday pleasure demand is of course largely to and from outlying districts, especially during the summer.

The ordinary weekly curve rises gradually throughout the six week-days and drops on Sundays in some cities and rises still further in others. The Sunday demand is naturally higher in summer than in winter.

The shape of the annual curve depends greatly on the nature of the city. Where it is primarily a business or industrial centre, the fluctuations from week to week are inconsiderable. Where it is a health or holiday resort they naturally reflect the seasonal fluctuations in the life of the city. In the absence of special circumstances, the month with the greatest traffic is usually October.

(*d*) *Conditions of Storage.*

It is absolutely impossible to store a service. Tramway services have therefore to be produced at the very moment when they are consumed. The effect of this fact, which alone would render the problem of the peak of greater importance in the tramway than in any other public utility industry, is slightly modified by the fact that consumers of tramway services are more willing to postpone or accelerate their demands than are consumers of water, gas, or electricity. A tramway service therefore need not be continuous, so long as it is regular. If passengers' demands were indefinitely postponable the problem of the peak would disappear entirely. In practice, the willingness of passengers to wait determines the extent to which the peak can be smoothed out. The time interval thus made available may be anything from a matter of a few minutes only on busy routes, which is not of great importance, to an hour or so on outlying routes, where the peak does not usually present a practical problem at all. A more important effect of passengers' willingness to travel according to a time-table is that it permits a higher degree of utilization of seating capacity or alternatively the employment of larger tram-cars. To provide continuous facilities

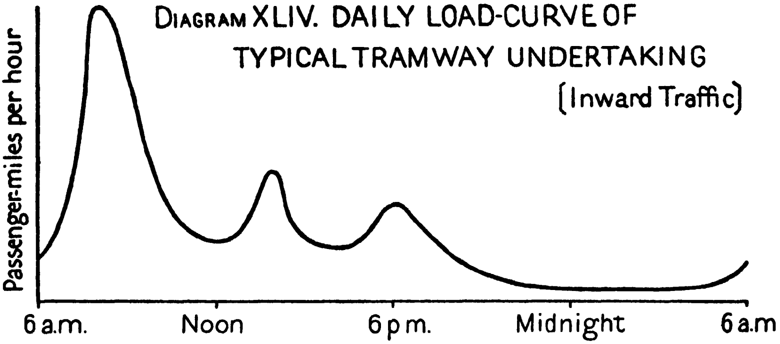


Diagram XLIV. DAILY LOAD-CURVE OF TYPICAL TRAMWAY UNDERTAKING

(Inward Traffic)

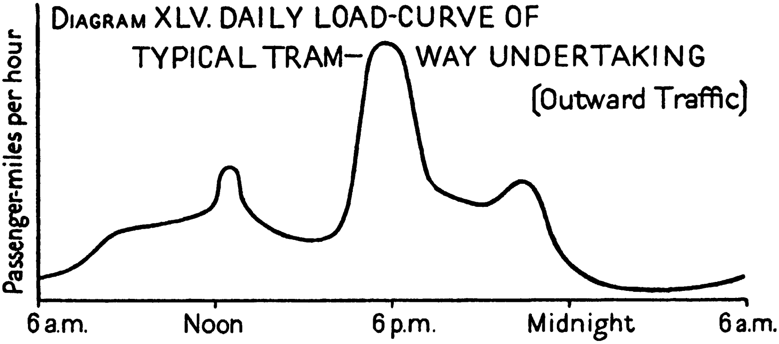
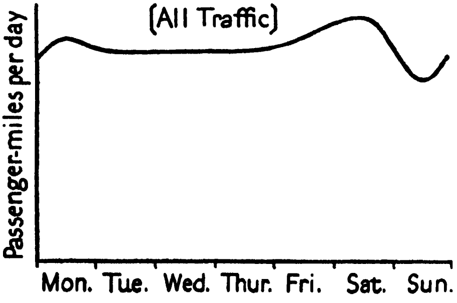


Diagram XLV. DAILY LOAD-CURVE OF TYPICAL TRAMWAY UNDERTAKING

(Outward Traffic)

Diagram XLVI. WEEKLY LOAD-CURVE OF TYPICAL TRAMWAY UNDERTAKING


(All Traffic)

on all routes would of course be an impracticably expensive undertaking, and the patience of passengers is a virtue born of necessity.

(*e*) *Area of Supply.*

Tramways are primarily an intra-urban means of transport; but they not uncommonly extend into suburbs that are outside the jurisdiction of the municipality that owns them, and sometimes they connect two entirely independent towns. In such cases the owning municipality will doubtless often wish to benefit its own ratepayers at the expense of other passengers. But to do this is much more difficult than in the case of, say, water-supply. Ordinary passengers cannot be interrogated as to their citizenship, although some sort of distinction might be made between different classes of season-ticket holders. But in any case such distinction would be likely to arouse public disapproval, or even more probably the disapproval of regulating authorities. It might be safe to assume that most passengers live in the district from which they travel in the morning and to which they travel in the evening, and to differentiate prices accordingly. As far as Germany is concerned, this question does not appear to have become an item of practical politics, however.

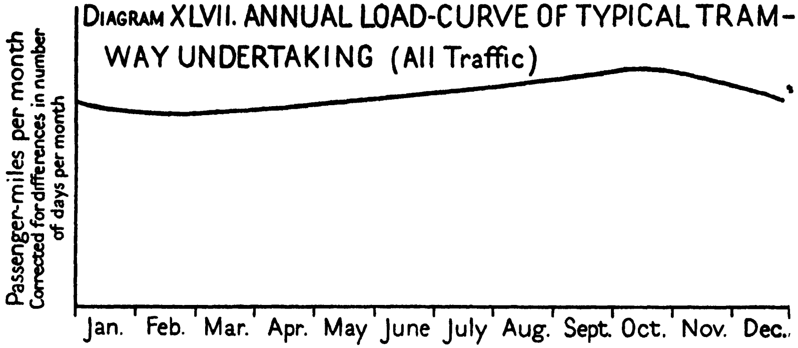


DIAGRAM XLVII. ANNUAL LOAD-CURVE OF TYPICAL TRAMWAY UNDERTAKING (All Traffic)

II: SOCIAL CHARACTERISTICS

(*a*) *Importance to the Community.*

Systems of passenger transport may exercise a great influence over the distribution of population. Some German municipalities seek to promote decentralization of population by arranging for cheap tramway services between residential suburbs and business and industrial quarters. In some cases, not the suburban zone as a whole but particular 'colonies' are singled out for preferential treatment of this nature.

Similar benefits to public health are sometimes aimed at by the provision of special facilities for travel from residential quarters to forests, gymnasiums, public baths, and the like. In Frankfort o. M., for example, special tickets giving the right of travel from any part of the system to the public baths and back, together with the right of admission, cost 70 pf. In Düsseldorf similar tickets for travel and admission to the municipal 'stadium' cost 60 pf. In the same city, books containing twenty tickets are issued to children during their official holidays at the cost of 2 marks. Each of these tickets gives the right to a journey of any length, and may be used either by the holder of the book or by any other school-children or children under school age travelling with him. The Düsseldorf tramways also charge only 40 pf. instead of the usual 50 for all long journeys on Sundays and public holidays.

Other fare reductions are granted with a view to assisting, not the community as a whole, but certain members of it whose need is thought to be greater or whose capacity to pay is thought to be smaller than the average. Such are school-children, students, apprentices, workmen, unemployed persons, blind persons, and cripples.

(*b*) *Consumption by the Community.*

The communal consumption of tramway services, at least during peace time, is not considerable. Policemen, aldermen, and other public servants are sometimes carried free or at reduced rates in discharge of their duties, but the importance of these cases is civic rather than economic.

FURTHER READING ON CHAPTER X

There is no standard German work on tramway fares. Useful articles occasionally appear in *Verkehrstechnik*, Ullstein, Berlin and Vienna.

KNOOP, D.: *Principles and Methods of Municipal Trading*. (See note on Chap. IV.) Special reference should be made to pp. 236-76.

CHAPTER XI

TRAMWAYS: CHARGES

I. CLASSIFICATION OF CUSTOMERS

THE classification of customers of German tramway undertakings is on the whole a 'social' rather than an 'economic' policy, i.e. a device for decreasing average fares rather than for increasing net revenue. The chief groups of passengers who pay reduced fares have already been referred to on p. 189. Every one of the twenty-six[1] undertakings provides special tickets for scholars as such. The prices charged for them are as shown opposite.

Reductions to scholars are given partly for social reasons, as forming part of the general educational policy, and partly for economic reasons, since much of this traffic would not bear the full prices. The main qualification for the use of scholars' tickets is that the user shall be a regular scholar attending a recognized educational institution. Sometimes an age-limit, higher than that for ordinary children's tickets, is imposed. Usually the tickets may be used only for journeys to and from the school. Thus in Frankfort scholars' tickets are valid only for journeys between school and home before 4 p.m., or at later hours only where compulsory classes are being attended; and in Essen 'on schooldays, only for travelling to and from school in accordance with a time-table, stamped by the school authorities, which is to be carried by the scholar; and on Sundays, for travelling to and from church services between 8 and 10.30 a.m.'.

Most undertakings also charge reduced fares for all children between certain ages. These are usually about half the ordinary fare, but unusually large reductions are made in one or two towns. The ordinary children's fares in such of the twenty-six undertakings as make reductions for children are shown on p. 192.

It will be seen that the reductions for children take different forms according to the general system of fares. Where a uniform fare is charged to ordinary adult passengers over the whole system (as in 11 of the 26 undertakings) the children's fare is usually about half of the adult fare. Where the ordinary fare varies with the length of the journey, the children's fares are sometimes uniform over the whole system and sometimes begin at the same level as the ordinary fares but increase less rapidly. The scales of fares in

---

[1] Hamburg and Altona have a common tramway system. So have Bochum and Gelsenkirchen.

TABLE XXXII

Scholars' Fares

Town	*Scholars' fare*	*Ordinary fare*	*Remarks*
Berlin	0·15	0·25	——
Hamburg	1·20	2·50	Weekly ticket. Each additional child in family, 0·60
Cologne	0·15	0·25	——
Munich	4·50	12·00	Monthly season for 2 fare-stages. One fare-stage 3·00
Leipzig	1·50	2·10	Weekly ticket
Dresden	1·60	2·00	Weekly ticket
Breslau	3·00	12·00	Monthly season
Frankfort	1·50	—	Packet of 25 tickets
	—	2·00	Packet of 12 tickets
Essen	3·00	—	2 journeys daily for a month
	6·00	—	4 journeys daily for a month
	—	12·00	Monthly season
Dortmund	3·00	9·00	Monthly season
Düsseldorf	0·70	1·20	2 journeys daily for a week
Hanover	3·00	—	Packet of 60 tickets
	—	2·00	Packet of 12 tickets
Nuremberg	3·60	9·40	Monthly season
Stuttgart	4·50	7·50–21·0	Monthly season
Chemnitz	3·50	25·00	Monthly season
Bremen	5·00	20·00	Monthly season
Magdeburg	4·00	14·00	Monthly season
Königsberg	4·00	7·00	2 journeys daily for a month. Extra child 2·00. Each further child 1·00
Duisburg	1·50	—	50 journeys
	—	2·50	30 journeys
Stettin	Details not available	0·20	——
Mannheim	1·20	3·00	Packet of 12 tickets
Bochum-Gelsenkirchen	3·50	—	60 journeys
	—	14·50	Monthly season
Kiel	5·00	—	Monthly season
	—	0·15	Single journey
Halle	1·00	—	Weekly ticket, 12 journeys
	—	0·15–25	Single journey
Barmen	3·00	8·00	Monthly season
Elberfeld	3·50	10·00	Monthly season

Duisburg and Barmen, which are respectively typical of these two systems, are as shown opposite.

TABLE XXXIII

Children's Fares

Town	*Age of children*	*Children's fare in pf.*	*Ordinary full fare in pf.*
Berlin . .	6–14	15	25
Hamburg . .	(*)	20–25 for one or two children	20–25
Cologne . .	4–10	15	25
Leipzig . .	(†)	10	25
Breslau . .	6–14	10	20
Frankfort . .	5–14	10	20–40
Essen . .	6–10	20–25	20–50
Dortmund .	6–10	10–30	20–60
Hanover . .	3–8	10–25	20–50
Stuttgart . .	4–12	10	15–40
Chemnitz . .	4–14	10	20
Bremen . .	4–14	10	20
Duisburg . .	6–14	20	20–70
Mannheim .	6–12	10	20–30
Bochum-Gelsenkirchen .	6–10	20–30	20–60
Kiel . .	4–10	10–15	15–20
Halle . .	Up to 10	10	15–25
Barmen . .	6–10	15–30	15–100
Elberfeld . .	6–10	20–60	20–160

(*) Under 14 years, over 1 meter high.
(†) Over four years of age, up till 8th school-year.

It is interesting to note that of the seven undertakings which do not make reductions for children, five employ the uniform-fare system and only two differentiate the fare according to the length of the journey.

The granting of cheap fares to children is chiefly a matter of what the traffic will bear. But where unusually large reductions are made the motive is obviously social.[1]

Students and apprentices are accorded special treatment by eight of the twenty-six undertakings, as shown in Table XXXV.

---

[1] In Vienna an ordinary ticket costs 32 Groschen and a child's ticket 6 Groschen. During September 1922 the fares were 1,000 and 100 Kr. respectively. Before the War they were 20 and 12 Heller respectively.

TABLE XXXIV

Typical Scales of Children's Fares

No. of fare stages	DUISBURG		BARMEN	
	Ordinary fare	*Children's fare*	*Ordinary fare*	*Children's fare*
1	20	20	15	15
2	20		20	15
3	25		25	15
4	30		30	15
5	40		35	15
6	40		40	20
7	55		50	20
8	55		60	20
9	70		60	20
10	70		60	20
11	70		70	25
12	—	—	70	25
13	—	—	70	25
14–16	—	—	80	25
17–19	—	—	90	30
20–22	—	—	100	30
each further 3	—	—	10	5

TABLE XXXV

Students' and Apprentices' Fares

Town	*Special fare*	*Ordinary fare*	*Remarks*
Cologne .	As scholars' fares	—	—
Munich .	3·00	—	Monthly season 1 fare-stage
	—	12·00	do., 2 fare-stages
Leipzig .	As scholars' fares	—	—
Dresden .	As scholars' fares	—	Apprentices only
Breslau .	5·00	12·00	Monthly season
Frankfort .	2·50	—	25 journeys
	—	2·00	12 journeys
Düsseldorf .	As scholars' fares	—	Apprentices
	3·50	—	Students, 25 journeys
Halle . .	1·00	—	Apprentices only, 12 journeys
,, . .	1·60	—	Students only, 12 journeys
,, . .	—	15–25	Single journey

The motives for granting these reductions seem to be similar to those for granting reductions to scholars.

Special workmen's tickets are provided by nine of the twenty-six undertakings. Their cost compares with that of ordinary tickets as follows:

TABLE XXXVI

Workmen's Fares

Town	*Workmen's fare*	*Ordinary fare*	*Remarks*
Cologne .	1·55	2·00	Weekly
Leipzig .	1·90	2·10	12 journeys
Frankfort .	1·00	2·00	Weekly
Nuremberg .	1·00	1·10	Weekly
Magdeburg .	1·60	1·70	Weekly
Mannheim .	2·20	2·60	12 journeys
Halle . .	1·60	—	12 journeys
	—	0·15–25	Single journey
Barmen .	1·00	—	Weekly
	—	0·15–20	Single journey
Elberfeld .	0·30	—	Return journey
	—	0·20–40	Single journey

It will be observed that workmen's fares are usually available only for those who buy weekly tickets. The average proportion between workmen's fares and the fares charged to other passengers travelling under equivalent or approximately equivalent conditions varies from about 20 to 90 per cent.

The definition of 'workman' varies in different undertakings. In Frankfort o. M. workmen's tickets are available 'exclusively for persons engaged in mechanical or manual labour for travelling between their homes and work-places'. Workmen's tickets are issued only to persons presenting certificates from their employers to the effect that they belong to the above category; and the tickets when issued must be signed by the holder and are non-transferable. The workmen's tickets issued by all other undertakings are likewise non-transferable; but in Mannheim they may be used by all wage-earners, in Barmen by all manual workers and any other employees whose income does not exceed 300 marks monthly, and in Nuremberg by workmen and apprentices engaged in manual labour and with an income not greater than 60 marks weekly or 3,000 marks annually. Only in Elberfeld, where workmen's tickets are not valid after 7.30 a.m., does the differentiation appear to have a directly economic basis. Where the reduction is purely in favour of manual workers as such it is doubtful whether it is not a little mistaken. 'It is difficult to see why artisans, mechanics and day labourers who travel in the early morning [or indeed at any other time] should receive facilities which men and women serving in shops, clerks, and others who are no better off financially, do not enjoy.'[1] The tariffs in use in Cologne, Mannheim, Barmen, and Elberfeld are free from objection in this respect, as including all such deserving cases within their definition of 'workman'. And in two other towns special facilities are extended separately to non-manual workers. In Leipzig special weekly tickets, on terms almost as favourable as those granted to workmen, are available for wage-earners with moderate incomes, and in Frankfort o. M. business men whose incomes do not exceed 6,000 marks per annum may obtain monthly tickets at a slightly higher cost than that of the workmen's tickets.

Blind persons and their companions are carried under special conditions by some undertakings. The motive in all cases is purely social, whether the undertaking receives direct compensation for this service or not. Details so far as they are available are as follows:

TABLE XXXVII

Blind Persons' Fares

	FARE		
Town	*For blind person*	*For companion*	*Compensation received by undertaking*
Cologne .	10 journeys for 10 pf.	—	Full
Breslau .	Monthly seasons, 4·00–8·00	—	Unknown
Frankfort .	Free	Free	None
Mannheim .	12 journeys for 1·50	—	Partial

A few other interesting cases of customer-classification by tramway undertakings deserve brief notice. Municipal officials are granted books of tickets at cheap rates in Munich. In Frankfort books of 12 tickets, valid for journeys of any length, are sold for one mark to the following classes of passenger: (i) people over 65 years of age in receipt of public assistance, (ii) veterans of the wars of 1866 and 1870–1, (iii) persons crippled during the Great War, (iv) certain other crippled persons, (v) certain persons of more than 60 years of age. In Leipzig persons crippled during the War are charged 10 pf. for each journey. In Düsseldorf and Frankfort special cheap combination tram and admission tickets are issued for the municipal 'stadia'. And in Mannheim monthly tickets for crippled persons cost 5 marks.

---

[1] Knoop, *Municipal Trading*, p. 266.

II. TARIFFS

It has been seen that, except for children's fares, customer classification is not widely adopted as a differentiatory device on German tramways except where it is desired to discriminate for social reasons. The amount of price-differentiation *within* tariffs varies considerably from town to town. It has been stated that tramway services may be regarded as two-dimensional, i.e. as varying with the number of passengers and with the distance travelled. With very few exceptions, fares vary strictly in proportion to the first factor. The only exceptions in the twenty-six undertakings forming the special subject of this study are the following: (i) special fares are often charged for parties of school-children; (ii) where more than one child in a family holds a season ticket, the fare for the second and subsequent children is sometimes less than that for the first child.[1]

But the relationship of fares to the second variable factor, viz. the distance travelled, is much more complex. In general, following the distinction made above, we may divide all possible relationships between these two variables into two groups, according as the fare varies in proportion to the distance travelled or is independent of it.

A. *Variation of Fare in Proportion to Distance Travelled.*

It has been pointed out that no tariff now in use in Germany attempts to relate fares exactly to distance travelled. There are, however, three kinds of tariff which relate the two with varying degrees of approximate correctness. These tariffs may be distinguished as fare-stage, uniform-fare, and transfer tariffs. The common characteristic of all is that the fares charged according to them are for journeys of definite maximum extent.

---

[1] e.g. in Hamburg a weekly ticket for the first child costs 1·20 marks and for each subsequent child 0·60. In Königsberg a monthly scholar's ticket costs 4·00 for the first child in a family, 2·00 for the next, and 1·00 for all subsequent children.

1. *The Fare-stage Tariff.* This tariff, which is employed on two-thirds of the tramways in Germany, takes different forms in Germany and in England. The usual German method of employing it is to divide the whole system into blocks or fare-stages and to charge a passenger of a given class a fare which varies with the number of stages travelled over. A map of the system showing the number and position of the fare stages is usually printed on the ticket, several types of which are necessary for each class of passenger, and this together with a scale of charges per section gives all the information that is necessary. Diagram XLVIII is reproduced from the ordinary tram tickets in use in Heidelberg. The tickets are usually punched or pencilled by the conductor to show the section at which the passenger begins his journey. Sometimes tickets such as these are available for one tram only, and sometimes they may be used as transfer tickets for reaching a destination by means of more than one tram. In either case the principle involved is the same, although under a transfer system the difficulties of operation are likely to be greater.

A disadvantage of the fare-stage method is that 'it penalizes people who commence or end their journey in the middle of a stage or section. This can be overcome to some extent by making the sections smaller and allowing more sections to be travelled for the fare paid,'[1] but this of course makes the system rather more complicated. The length of the sections in the twenty-six German undertakings varies from about a half to nearly two kilometres.

In no case does any attempt seem to be made to approximate to a true flat-rate method of charge, i.e. one in which the price charged varies in direct proportion to the distance travelled. Frequently some attempt is made to recognize the fact that a long journey, as far as the cost of single journeys can be discovered, costs the undertaking less than a number of shorter journeys of equal aggregate length, i.e. to recognize the existence of consumer costs. This is usually achieved by charging a minimum fare of 15 or 20 pf., however short the journey is, and increasing this fare more or less in proportion to each increase of distance. This method is adopted by all of the fifteen large German undertakings which employ fare-stage tariffs. In the terminology adopted in previous chapters these tariffs are of a two-part variety. Five of them have a minimum fare of 15 pf., and ten a minimum fare of 20 pf. The relationship between fare and distance does not vary greatly between undertakings and is in general approximated to by the formula

---

[1] Knoop, op. cit., p. 239.

$$F = 10 + KD,$$

where $F =$ the ordinary fare in pf., D the distance travelled in kilometres, and K a constant which has an average value of about three but is in some undertakings as high as five and in others as low as two.

2. *The Uniform-fare Tariff.* The uniform-fare tariff is employed on very few German tramways. It consists in charging a fixed price to a customer of a given class for the whole journey or fraction of a journey performed by one tram. The chief advantage of this method lies in its simplicity. 'There is no need for the whole system to be divided into stages, nor for some particular ticket to be specially punched by the conductor according to the points between which a passenger wishes to travel. The fares can be collected much more quickly, and a passenger runs no risk of paying too much, owing to his ignorance of the exact points at which fare stages begin and end. Before such a method of charging can be recommended, two important questions must be answered. Can such a policy enable a tramway system to be managed on a remunerative basis? If so, how high must the uniform fare be?'[1] These two questions, however, are merely aspects of the larger question, Will such a policy pay?—a question which many undertakings have to answer in the negative. For whether such a policy will pay or not in comparison with the fare-stage system will depend on (i) the saving due to the increased simplicity of working, less (ii) the net diminution of gross revenue due to loss of passengers. The effect on gross revenue of substituting the uniform-fare for the fare-stage system depends on the extent to which short-distance passengers are lost and long-distance passengers gained by the change. It is reasonable to suppose that the demands of long-distance passengers are much less elastic than those of short-distance passengers, and it is therefore likely that loss in net revenue will result from the substitution of a uniform-fare for a fare-stage tariff. The amount of this loss is likely to be greatest where the difference between the sets of fares payable under the two systems is greatest.

---

[1] Knoop, op. cit., p. 236.

Now this difference will be greatest where the differences between the lengths of the journeys undertaken by different passengers are greatest. Journeys on any given route are *a priori* most likely to be of the same length when the route is shortest. And the average length of journeys on one route is *a priori* most likely to be equal to the average length of the journeys on another when the two lines are of the same length. The substitution of a uniform-fare for a fare-stage tariff is therefore likely to lead to the smallest losses in those systems where the routes are shortest and most nearly equal in length to each other.

Experience would seem to confirm this view. In Halle, although the uniform-fare system was twice forced on the management of the tramways, the subsequent loss of revenue in both cases led to a resumption of the fare-stage system.[1] Again, in Hamburg, when the uniform-fare system was introduced, 'the result was a loss of 14 per cent. of the short-distance passengers and a gain of only 3 per cent. of the long-distance passengers'.[2] As has been said, this probable loss is to be balanced against the gains resulting from the simplicity of the one-price system. These gains are likely to be biggest in those cities where the traffic has the greatest tendency to outrun the capacity of the system, i.e. in general in the very large cities. On the whole it may therefore be said that from the economic point of view the uniform-fare system is justifiable only where the different routes of the system are of similar and moderate length, and most justifiable where these conditions obtain in a very large city.

The uniform-fare system is sometimes defended on grounds of its social desirability in 'that it helps to relieve the congestion in the centres of big towns'.[3] But 'this does not appear necessarily to follow. In the first place, a long journey by tram requires much time, which many people would be unwilling to sacrifice, even if the fare were merely nominal; in the second place, to make the undertaking remunerative it may be necessary to fix the uniform fare so high as to discourage a considerable number of people from using trams at all, and thus people will be compelled to live close to their work.'[4]

In the memorandum from which quotations have already been made the thesis is argued that a suitably planned fare-stage system of tariffs may be socially more desirable than a uniform tariff, quite apart from economic considerations. In support of this contention the statement is made that where a uniform-fare system is adopted no margin of profit can be spared for the purpose of giving reductions to special classes of the community, whereas the more profitable fare-stage system does permit the granting of considerable special facilities to especially deserving classes. 'Frankfort with its manifold and extensive special tariffs stands in the front rank in this connexion, although this does not necessarily imply that such a situation is a very desirable one from the point of view of the tramway.'[1] To what extent conclusions based primarily upon the achievements of Frankfort are also true of other large German towns, may be seen from Table XXXVIII.

---

[1] *Denkschrift über die Frage der Einführung eines Einheitstarifs bei der Strassenbahn*, Dr. Schmude, Frankfort, p. 13.

[2] Ibid., p. 13.

[3] Knoop, op. cit., p. 237.

[4] Ibid., loc. cit.

3. *The Transfer Tariff.* A logical extension of the uniform-fare system is the transfer system. Under this, a single fare is charged for the journey from any point in the system to any other point, whether the completion of the journey involves changing cars or not. The system is employed by six of the twenty-six undertakings, although it is logically more difficult to defend than the uniform-fare system. Its principal effect in comparison with that system is to increase the disparity between the lengths of journeys and so also the probable decrease of revenue subsequent upon its introduction. There are at least three further objections to it. (i) It is in no particular simpler than the uniform-fare system, except so far as it is simpler for a conductor to receive a ticket from a passenger and examine it than to receive money and perhaps give change. (ii) It is in certain particulars more complicated than the single-fare system. A single mark on the ticket is insufficient to control completely the use of it, and most transfer tickets have to be punched or marked in three places in order to prevent misuse. (See Diagrams XLVIII–LI and notes appended thereto.) (iii) And despite the complexity of ways of cancelling tickets, this method lays itself open to grave danger of fraud. It is practically impossible to ensure that transfer tickets will be used on the next available car, as the regulations of most undertakings require; and yet if the ticket is available for further use without restriction as to time, fraud is inevitable. A transfer ticket may, for instance, be used not for completing a bona-fide direct journey from *A* through

---

[1] Schmude, op. cit., p. 8.

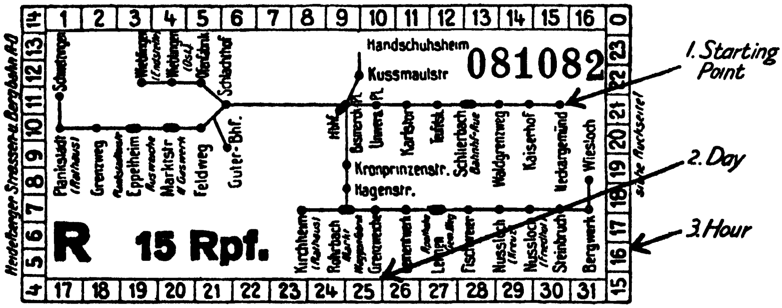
TABLE XXXVIII. *'Social' Tramway Tariffs*

Town	SPECIAL TARIFFS FOR						*No. of special tariffs*
	Children	*Scholars*	*Students & apprentices*	*Work-men*	*Blind persons*	*Others*	
1. *Undertakings with Fare-stage Tariffs*:							
Hamburg	*	*	—	—	—	—	2
Munich	—	*	*	—	—	*	3
Frankfort	*	*	*	*	*	***	8
Essen	*	*	—	—	—	—	2
Dortmund	*	*	—	—	—	—	2
Düsseldorf	—	*	*	—	—	**	4
Hanover	*	*	—	—	—	—	2
Stuttgart	*	*	—	—	—	—	2
Duisburg	*	*	—	—	—	—	2
Mannheim	*	*	—	*	*	*	5
Bochum and Gelsenkirchen	*	*	—	—	—	—	2
Kiel	*	*	—	—	—	—	2
Halle	*	*	*	*	—	—	4
Barmen	*	*	—	*	—	—	3
Elberfeld	*	*	—	*	—	—	3
Average no. of tariffs in Class 1	0 9	1·0	0·3	0·3	0·1	0·5	3·1
2. *Undertakings with Uniform Tariffs*:							
Leipzig	*	*	*	*	—	—	4
Dresden	—	*	*	—	—	—	2
Nuremberg	—	*	—	*	—	—	2
Bremen	*	*	—	—	—	*	3
Magdeburg	—	*	—	*	—	—	2
Average no. of tariffs in Class 2	0·4	1·0	0·4	0·6	0	0·2	2·6
3. *Undertakings with Transfer Tariffs*:							
Berlin	*	*	—	—	—	—	2
Cologne	*	*	*	*	*	—	5
Breslau	*	*	*	—	*	—	4
Chemnitz	*	*	—	—	—	*	3
Königsberg	—	*	—	—	—	—	1
Stettin	—	*	—	—	—	—	1
Average no. of tariffs in Class 3	0·7	1·0	0·3	0·2	0·3	0·2	2·7
Average no. of tariffs in all undertakings	0·7	1·0	0·3	0·3	0·2	0·3	2·9

B to *C*, but for making the two distinct journeys from *A* to *B* and from *B* to *C*. Some undertakings recognize this, and make no attempt to prevent such use of transfer tickets. In Berlin, for example, the only rule relating to the time of use of transfer tickets is that the whole journey must be completed within an hour and a half of the time of issue of the ticket. This method of cutting the Gordian knot naturally means a further serious loss of revenue. And it leaves quite unsolved the more difficult problem of preventing the use of tickets by persons who did not purchase them from the undertaking in the first place. Professor Knoop in 1912 quoted some surprising facts relating to abuses of the transfer system in the United States, where it originated. 'During 1908–9 a crusade was conducted against the misuse of transfers, and over one thousand arrests were made within a year. During the year 373,000,000 passengers were carried, of whom 153,000,000 rode on transfers. At the time when the crusade was started the sale of transfers at junction points and in stores was quite general.

DIAGRAM XLVIII

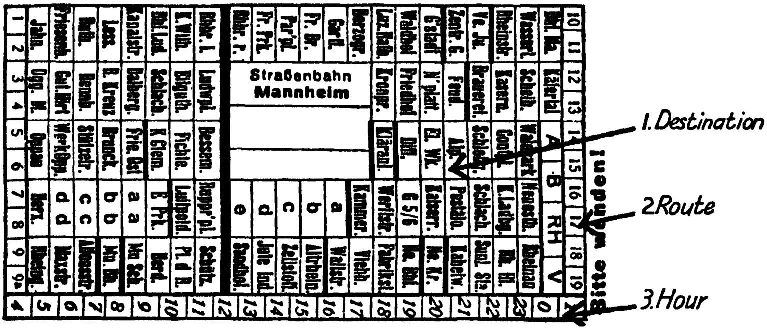
Typical Fare-stage Tariff Tram Ticket, Map Type



Several of these tickets are needed to cover the whole system, and if used as transfer tickets they need to be punched in three places—once to show the starting-point, once for the day of the month, and once for the hour of the day. If used as single fare-stage tickets they need only to be punched once to indicate the starting-point. The following regulations are printed on the reverse side: 'This ticket is not transferable and is valid only for the journey for which it is punched and issued. As transfer ticket valid only for the next available tram at the following stopping-places: Hauptbahnhof, Bismarckplatz, Brückenkopfstrasse, Karlstor, Schlachthof, Czernybrücke, Kronprinzenstrasse and Rohrbach (Markt.).' (Reproduced by kind permission of the Heidelberger Strassen- u. Bergbahn A.G.)

DIAGRAM XLIX

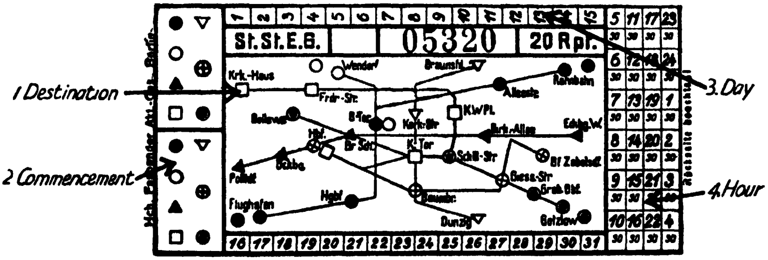
Typical Fare-stage Tariff Tram Ticket, List Type



Several of these tickets are needed to cover the whole system and if used as transfer tickets they need to be marked in three places—once to indicate the destination, once to indicate the number of the route on which the journey is begun, and once to indicate the hour of issue. If it were thought necessary to indicate the date of issue as well, four marks would therefore be necessary. When used as single fare-stage tickets these need only be marked once, to indicate the destination. The reverse side bears a diagram of the whole system (for the convenience of the passenger—and perhaps of inexperienced conductors) and the following regulations: 'As transfer ticket available only at the transfer points indicated by the conductor and for the next tram to depart that is not fully occupied. The journey is to be made by the shortest route.' (Reproduced by kind permission of the Mannheim Tramways.)

DIAGRAM L

Typical Uniform Transfer Tariff Tram Ticket, Map Type

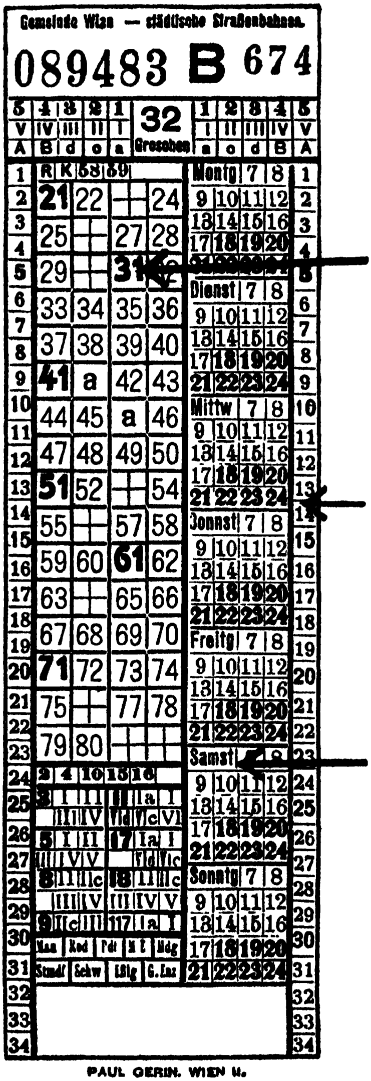


This one ticket serves for the whole system and since it is always issued as a potential transfer ticket needs to be punched in four places, to indicate: (1) destination; (2) place and direction of commencement of journey; (3) day of month of issue; (4) half-hour of issue.

The reverse bears the following regulations: 'Not transferable. Valid for the shortest journey to the destination. Two transfers permitted if necessary. Circular and return journeys prohibited. Transfers must be made at the first available transfer-point without interruption of the journey.' (Reproduced by kind permission of the Stettin Authorities.)

DIAGRAM LI

Typical Uniform Transfer Tariff Ticket, List Type



1. Route and section of route

2. Direction of journey and week of issue

3. Day and hour of issue

This one ticket serves for the whole system, either as a simple or as a transfer ticket. It has to be punched in three places: (1) to indicate the route and section of the route; (2) to indicate the direction of the journey and the week of issue; (3) to indicate the day and hour of issue. This method of cancelling demands encyclopaedic knowledge of all the routes on the part of all conductors and inspectors. (Reproduced by kind permission of the Vienna Municipal Tramways.)

At one point there were a dozen newspaper boys who solicited transfers from passengers and sold them to others. Testimony given in court showed that at this crossing alone each of the boys derived a revenue of 1 dollar to 3 dollars a day from this source. There were other corners where the unlawful sale of transfer slips was almost as extensive. But the greatest injury to the company's business was done at points where hundreds of transfers were not sold but thrown down, picked up, or traded daily. At one place where three important lines connected, it is estimated that several hundred transfers were presented daily by people who had not received them from a conductor. On some lines in the United States the average revenue per passenger has been brought from 5 cents to the neighbourhood of 3 cents by the rapid spread of the legitimate use of transfers, accompanied by an even more rapid increase in the illegitimate use of the privilege.'[1] Germans are notoriously more law-abiding than Americans, and the alarming experiences of Chicago cannot be regarded as a precedent for Königsberg or even Berlin. But it is doubtful if the transfer system does not cost many German undertakings, in inspection and direct loss, more than is commonly admitted.

Probably the only real advantage to the undertaking in the issue of transfer tickets lies in their value in persuading passengers into completing by tram a journey which they otherwise would have completed in some other manner.

Sometimes a compromise between the ordinary single-fare and the transfer system is employed, single-journey tickets being issued at one price and transfer tickets at a slightly higher price. This system is adopted in Dresden, for example, where an ordinary ticket costs 20 pf. and a transfer ticket 25 pf.

The table on p. 206 shows the extent to which the various types of tariff are employed for ordinary passengers (i) among the twenty-six undertakings which form the special subject of the present study, and (ii) among the undertakings which belong to the Verband deutscher Verkehrsverwaltungen, i.e. practically all the tramway undertakings in Germany.

The principle of giving 'reductions for quantities' is recognized in tramway undertakings not only by charging fares less than directly proportional to the length of single journeys, but also by allowing several journeys to be undertaken at less than a corre-

---

[1] Knoop, op. cit., p. 259.

TABLE XXXIX

Types of Tramway Tariffs

Type of Tariff	Fare in pf.	NO. OF UNDERTAKINGS (i) among 26 towns	NO. OF UNDERTAKINGS (ii) among members of V.D.V.
1. Fare-stage	10*	—	8
	15*	5	60
	20*	10	42
	25*	—	1
	All	15	111
2. Uniform	10	—	2
	15	1	4
	20	3	3
	25	1	2
	30	—	1
	All	5	12
3. Transfer	10	—	1
	15	—	17
	20	4	23
	25	2	3
	All	6	44
TOTAL	All	26	167

* Minimum.

sponding number of times the cost of one. There are two usual methods of doing this. One is the issue of weekly tickets which give the right to two (or sometimes four) daily journeys for a six-day week at less than twelve (or twenty-four) times the cost of one journey. The other is the issue of books of tickets at less than the face value of the tickets contained in them. The principles involved are not the same in both cases. The users of weekly tickets are 'regular customers' and as such are cheaper for the undertaking to deal with than are passengers who make an equal number of journeys at totally unpredictable times. But the users of booklets of tickets are not necessarily regular customers at all, and it is very difficult to see in what way a passenger who takes twelve journeys at totally unpredictable times is better for the undertaking than twelve independent passengers, except indeed that the single passenger could not contribute so intensively to a peak as the twelve could. In some undertakings the booklets of tickets are even transferable between persons, and in such cases it is very difficult to conceive of any justification of the practice whatever; for the conductor's trouble in receiving and checking a (probably rather crumpled) ticket from a passenger is certainly not less than his trouble in receiving money and extracting a ticket from his own wad.

Perhaps the chief reason for the existence of books of tickets is,

TABLE XL

Books of Tickets and Weekly Tickets

	BOOKS OF TICKETS		WEEKLY TICKETS		ORDINARY TICKET
Town	*No. of journeys*	*Price, RM.*	*2 daily journeys, RM.*	*4 daily journeys, RM.*	*Single journey, RM.*
Hamburg	12	2·50	2·50	—	0·20–0·25
Cologne	5	1·00	2·00	3·50	0·25
Munich	10	2·00	1·30–1·60	2·20–2·80	0·15–0·25
Leipzig	6	1·30	2·10	—	0·25
Dresden	12	2·00	—	—	0·20
Breslau	6	1·00	—	—	0·20
Frankfort	12	2·00	—	—	0·20
Essen	6	1·00	1·60–3·25	—	0·20–0·40
Dortmund	—	—	9·00–18·00	—	0·20–0·60
Düsseldorf	—	—	1·20–2·10	2·20–3·50	0·20–0·50
Hanover	12	2·00	1·50–4·50	—	0·20–0·50
Nuremberg	10	1·40	1·10–1·30	2·20–2·60	0·15
Stuttgart	—	—	1·40–2·30	—	0·15–0·40
Chemnitz	—	—	1·50	—	0·20
Bremen	6	1·00	—	—	0·20
Magdeburg	10	1·70	1·70	—	0·20
Königsberg	6	1·00	—	—	0·20
Duisburg	6	1·00–1·50	—	—	0·20–0·30
Stettin	11	2·00	—	—	0·20
Mannheim	6	1·10	—	—	0·20
,,	12	2·60–3·00	—	—	0·25–0·30
Bochum and Gelsenkirchen	—	—	1·80–6·00	—	0·20–0·60
,,	10	2·10–4·20	—	—	0·20–0·40
Kiel	10	1·25–1·65	0·45–0·60*	—	0·15–0·20
,,	30	3·75–5·00	—	—	—
,,	60	7·50–10·00	—	—	—
Barmen	†	†	—	—	—
Elberfeld	—	—	1·40–7·20	—	0·20–1·60

* 1 journey daily.

† A packet of 20 tickets with a face value of 10 pf. and 20 with a face value of 5 pf. costs 2·60.

like that for the existence of transfer tickets, purely psychological. That is to say, perhaps certain passengers, attracted by the notion of a 'bargain', use the trams more under a book system than they would if they had to pay for each ride in coin of the realm. Perhaps, too, the undertakings gain a little from being paid in advance. But against these advantages must be set not only the reduced average fare but the danger of fraud and abuse.

Variation of Fare independently of Distance Travelled.

The other main principle upon which tramway fares may be based, mentioned on p. 196, is to charge each passenger of a given class a sum which does not vary with the actual distance travelled during a given period. The method of applying this principle is usually the issue of season-tickets which permit the holder to travel as often as he desires either over the whole system or over a specified portion of it during a given period, usually a month. Such tickets are issued by twenty-three of the twenty-six undertakings.

The advantages of the system are as follows: (i) It encourages the extra use of the tramways; and this extra use is most likely to occur off the peak, when it will cost the undertaking least. (ii) It is simple, and saves the conductor and passenger an appreciable amount of time and trouble. The only serious objection to it is that it is liable to be abused, especially by the use of tickets by more than one person. But this danger can be reduced by requiring the holder's photograph to be affixed to the ticket, as is the common practice in Germany. In certain cases transferable season tickets are issued, when this objection is of course no longer valid. Season tickets can only be issued with advantage to such classes of passenger as are likely to make use of the facilities afforded to an extent that can be roughly estimated, at least within peak-hours; i.e. for practical purposes, to those passengers who travel regularly during the rush-hours. Table XLI shows the conditions under which season-tickets are issued to ordinary passengers among the twenty-six undertakings.

Table XLII[1] shows the relative use made of season and other special ticket facilities in the twenty-eight towns of the present study.

---

[1] Based upon material in the *Statistisches Jahrbuch deutscher Städte*, 1930.

TABLE XLI

Monthly Season Tickets

Town	*Season ticket cost in marks**	*Ordinary single journey in marks*
Berlin	10·00–30·00	0·25
Hamburg	20·00–35·00	0·20–0·25
Cologne	30·00	0·25
Munich	12·00–27·00	0·15–0·25
Leipzig	14·00–35·00	0·25
Breslau	12·00–34·00	0·20
Frankfort	10·00–25·00	0·20–0·40
Essen	12·00–30·00	0·20–0·50
Dortmund	25·00	0·20–0·60
Düsseldorf	12·00–36·00	0·20–0·50
Hanover	14·00–32·00	0·20–0·50
Nuremberg	9·40–18·00	0·15
Stuttgart	7·50–21·00	0·15–0·40
Chemnitz	25·00	0·20
Bremen	20·00†	0·20
Magdeburg	14·00–17·50	0·20
Königsberg	18·00–30·00	0·20
Duisburg	10·00–35·00	0·20–0·70
Mannheim	15·00–30·00	0·20–0·30
Bochum and Gelsenkirchen	14·50–32·50	0·20–0·60
Halle	10·00–25·00	0·15–0·25
Barmen	8·00–30·00	0·15–1·00
Elberfeld	10·00–30·00	0·20–1·60

* The lower price is usually for one route, the higher for the whole system.
† 6-monthly season ticket, 100·00.

It will be observed that the price of a season ticket is usually equivalent to that of about 100 single journeys per month at the ordinary fare.

In three interesting types of case special fares are charged according to the time when a journey is made. Some undertakings charge reduced fares, especially for routes into the country, on Sundays and holidays. On the Rheinische Bahn-Gesellschaft (Düsseldorf), for instance, a journey of more than eleven fare-stages costs 50 pf. on week-days and 40 pf. on Sundays and holidays. The motive in such cases appears to be partly to increase facilities for the improvement of public health and partly to build up the weekly demand curve.

TABLE XLII

Use of Tramway Facilities in twenty-eight Towns

	No. in thousands of tickets sold on German tramways in 1928 or 1928–9			
Town	*Single transfer and exchange tickets*	*Weekly tickets*	*Monthly tickets*	*Scholars' monthly tickets*
Berlin	561,324	—	1,591	95
Hamburg and Altona	200,610	2,523	91	—
Cologne	48,281	4,305	20	—
Munich	118,762	1,992	60	117
Leipzig	73,079	30,116	9,172	843
Dresden	69,132	—	58	—
Breslau	50,177	—	94	48
Frankfort	80,287	2,837	163	—
Essen	58,878	—	—	—
Dortmund	44,351	—	8	5
Düsseldorf	42,960	3,650	39	76
Hanover	64,744	200	9	—
Nuremberg	50,280	949	38	16
Stuttgart	81,563	568	239	23
Chemnitz	30,999	1,280	2	13
Gelsenkirchen	15,671	21	8	13
Bremen	52,809	—	54	7
Magdeburg	44,337	—	32	—
Königsberg	14,952	—	43	22
Duisburg	10,872	—	23	9
Stettin	25,294	—	11	7
Mannheim	14,934	—	38	—
Bochum	18,892	45	23	10
Halle	23,943	227	13	—
Barmen	9,093	361	19	—
Elberfeld	9,461	26	16	5

In Frankfort o. M. a specially low fare is charged for all journeys between the hours of 9 a.m. and noon on week-days and before noon on Sundays, journeys of any length being charged the same as the shortest journeys on the ordinary scale. The motive here is undoubtedly the desire to build up the daily demand curve.

Finally, most undertakings charge higher fares for journeys made during the night. This might at first appear an illogical proceeding, seeing that the night is decidedly an off-peak period for tramways; but it is to be explained by the fact that the very sparse nature of the night traffic renders its *attributable* costs much higher per passenger than the average total costs of the whole undertaking. The charges made for night services are shown in the following table:

TABLE XLIII

Fares for Night Journeys

Town	*Night fare in pf.*	*Ordinary fare in pf.*
Hamburg	30	20–25
Cologne	50	25
Munich	40	15–25
Leipzig	50	25
Dresden	40, 50	20, 25
Breslau	30	20
Stuttgart	30–80*	15–40
Chemnitz	40	20
Bremen	40	20
Magdeburg	25	20
Königsberg	30	20
Mannheim	40	20–30
Kiel	20–25	15–20
Halle	25–35	15–25

* Saturdays and Sundays only.

Apart from these cases no systematic attempt appears to be made to charge more for peak than for off-peak service. Indeed, the rush-hour passengers are largely those who obtain reductions through the use of weekly or monthly tickets. But it must not be forgotten that rush-hour service is usually of an inferior quality to the service provided at other times and that consequently peak passengers may often be differentiated against without the differentiation being explicitly expressed in the tariff.

The question of classification of tramway passengers is admittedly on the whole a social problem in Germany under present conditions, the solution of which depends on the social views of the regulating or operating authority. The sole important exception is the class of children for which the principle of charging what the traffic will bear seems to justify cheaper fares, especially where families are large.

The main issue regarding the form of the general tariff is between the fare-stage, the uniform-fare, and the transfer systems. Fortunately it seems possible to formulate a conclusion relating to this problem which is of wide if not of universal application. The conclusion is that the transfer system is not in general to be recommended, and that the uniform-fare system is only to be recommended where the volume of traffic is such as to render a simplification of the conductors' tasks desirable and where the probable variation of lengths of journeys is small. There can be no question as to the desirability of special reductions for journeys made outside rush hours so long as such reductions result in a more than proportionate increase of the traffic to which they apply. And there can be no question as to the desirability of the issue of season tickets at prices calculated to stimulate an increase of traffic outside peak hours.

FURTHER READING ON CHAPTER XI

No general information respecting tram-fares is available in Germany at present, although the Verband deutscher Verkehrsverwaltungen collects such information for the benefit of its members.

KNOOP, D.: *Principles and Methods of Municipal Trading.* (See note on Chap. X.)

CHAPTER XII

CONCLUSION

THE construction of a systematic body of thought on the economic aspects of public utilities would satisfy a want that is beginning to make itself widely felt, and that will be still more widely felt in the near future.

Such a body of thought would constitute a 'public utility economics' only in a convenient but inaccurate sense, i.e. it would not be contradictory or even supplementary to 'ordinary' economics, but would form part of the general system of economic science. And as such it would concern itself chiefly with the pricing processes in public-utility industries, and would deal with them positively and not normatively. The present study attempts to provide some materials for the inductive study which must precede the formulation of a body of doctrine of this nature.

A comprehensive theory of the economics of public utilities would be of use to at least three classes of student. To the economist it would be of great value as dealing with some of those border-line problems, the solution of which would materially assist in clarifying and solving problems of a much wider scope and more fundamental significance. Among the questions of theory thus specially affected may be mentioned the following:

i. What are overhead costs? Do they differ from joint costs in kind or in degree only or not at all?
ii. What is discrimination?[1] What are its results?
iii. What are the forces that keep prices of different units of a commodity uniform? How far are uniform prices 'natural' under a system of free competition?[2]
iv. Through what channels can external forces act upon the pricing process? And with what results?

It would, secondly, be of value to politicians and public administrators. This value must not be over-estimated. A purely economic doctrine of government intervention in industry is no more imaginable than a purely economic doctrine of, say, marriage. Economic science is, or should be, able to indicate the chief material advantages and disadvantages of certain courses of action; but

---

[1] See p. x, note.

[2] Ibid.

homo sapiens, unlike *homo economicus*, will not be influenced by these considerations alone. Nevertheless, it would not be easy to exaggerate the importance of assured knowledge as to what would and what would not be possible and profitable in the way of interference with the pricing process.

And a settled body of economic theory concerning public utilities could not fail to be of great value to the public utilities themselves —i.e. to industries employing some 10 per cent. or more of the resources of advanced countries and satisfying basic needs of modern urban and industrial civilization.

It is now generally recognized that public utility undertakings have a great deal to learn from one another, especially in the matter of charging for their products. When resources and markets are as immobile as they are in the public utility industries, local conditions necessarily vary so much as to render valueless all comparisons of mere price-levels, and undertakings have reason for discouraging that kind of uninstructed criticism which finds in the 10-pfennig tariff of one undertaking a proof of the knavery or inefficiency of all undertakings charging 15 pf. or more. But the obvious remedy is not less information relating to tariffs, but more; and the information should relate to methods rather than amounts. For if ordinarily efficient management takes care of the form of the tariffs, the prices will take care of themselves.

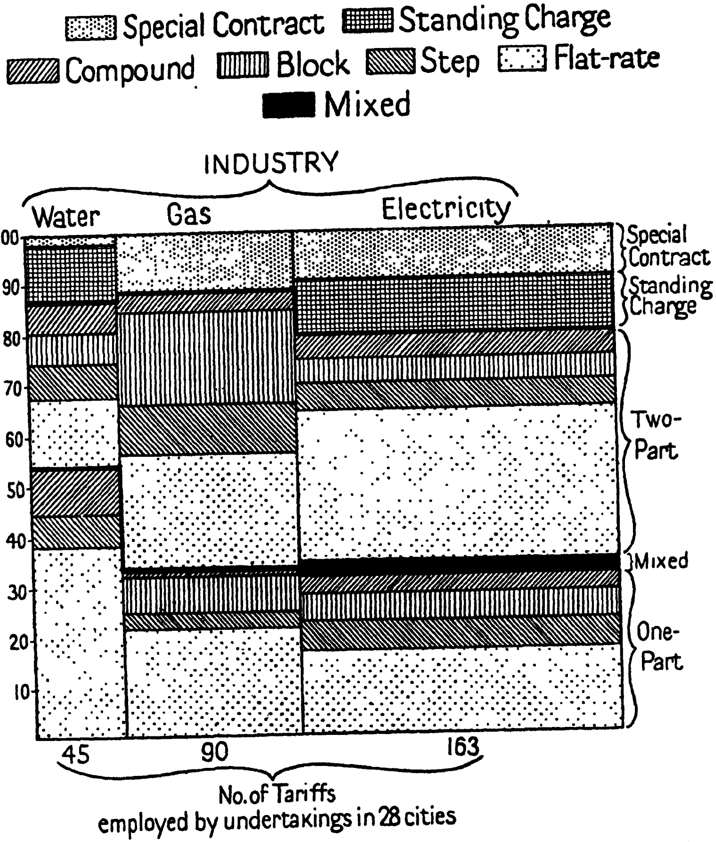
One interesting fact that emerges from a study of German public utility tariffs is that on the whole publicly-operated undertakings, at least in the larger towns, tend to employ more tariffs and more complicated tariffs than are employed by undertakings in private hands. This fact and others suggest that one of the two forms of management could profitably take some lessons from the other.

It is not yet widely recognized that not only undertakings within a given industry but also different public utility industries have much to teach one another. General principles apply to all public utilities, and although the varying influences of social and load-curve considerations will prevent a uniform application of these principles in all industries, they could undoubtedly be applied with profit more uniformly than they are at present. The following diagram, for instance, compares the number and type of tariffs in use in three of the four local utility industries;[1] and although, taking into account the social significance of the business of water-supply and the special conditions of electricity supply and the provision of tramway services, complete similarity of methods of charging would not be expected, the dissimilarity shown by the diagram

---

[1] The peculiarities of tramway tariffs make it desirable to leave them out of such a comparison as the above.

DIAGRAM LII. TARIFFS IN THREE LOCAL UTILITIES



suggests an undue amount of inter-industrial immobility of ideas. Not merely the local utilities, but the railway, telegraph, telephone, air transport, and postal industries could all contribute to and receive benefit from a pooling of ideas.

The broad principles that are of general application have already been referred to. The most important of them relate to the problem of differentiation, which may be briefly summarized as follows: Differentiation on the one hand permits (but does not ensure) a more complete utilization of resources than the charging of a uniform price would be likely to lead to; and on the other hand, differentiation may involve the abandonment of the general present-day practice of charging the same price for what consumers regard as equivalent commodity units, although it is certainly difficult to say whether this is a matter of principle or of expediency.

In Germany at present it would seem that in the gas and tramway industries in particular there is much room for experiment. In the electricity industry perhaps the chief need is for a certain measure of consolidation and standardization. Large-scale selling is on the whole conducted more scientifically than small-scale, except—and the exception is important—where undertakings are persuaded into giving unnecessary concessions to the bargaining strength of some of their larger customers. The domestic and small-industrial fields still offer great scope for development and their tariffs merit special attention.

There is at the present day a general political presumption against unnecessarily restrictive legislation concerning prices. A certain standardization of methods of charging is desirable as being helpful to consumers and as facilitating comparisons; but not at the cost of prevention of experiment. This would remain true even if one type of tariff scheme were demonstrably superior to all others, which is still very far from being the case.

INDEX

The Lists of Tables and Diagrams on pp. xvii and xix should also be consulted. Most of the following entries relate to recent German experience; the most important of those with a more universal reference are marked with an asterisk (*).

Accumulators, employment of, 145; tariffs, 164–7. *See also* storage of electricity.
Acworth, Sir W., imputation of overhead costs, 65, 67–70.
Advertisement Tariffs, for electricity, 163 f.
Alban, F. J., 64.
Altona:
  electricity undertaking, history of management, 48.
  gas undertaking, private establishment, 21; slot-meter tariff, 127; special tariff, 123.
  municipal company not formed from public undertakings, 46 *n.*
  tramway undertaking, children's fares, 183 *n.*; common with Hamburg, 190 *n.*
  water undertaking, industrial tariff, 91, 94, 98; meter rents, 103 f.; special tariff, 90.
  See also tables and diagrams.
Area, of electricity supply, 150 f.; of gas supply 116 f.; of tramway facilities, 188; of water supply 84 f. *See also* price-differentiation, between areas.
Asche, B., 9 *n.*

Bachmeyer, Dr., 9 *n.*
Barmen:
  electricity, advertisement tariffs, 163 *n.*; pioneer in public supply, 19; special industrial tariff, 166.
  tramways, children's fares, 192 f.; definition of workman, 194 f.
  water-supply, industrial tariff, 94, 100.
  See also tables and diagrams.
Becher, J. J., 75 *n.*
Benham, F. C., 6 *n.*
Berlin:
  electricity, pioneer in, 19, 22; special industrial tariff, 166; standing charges, 174 *n.*; tariff scheme, 168 *n.*
  gas, Deutsche Gas-Gesellschaft, 11; municipalization, 21, 31; pioneer in private supply, 19.
  municipal company not formed from public undertakings, 46 *n.*
Berlin (*cont.*)
  tramways, history of management, 48; pioneer in private management, 19.
  See also tables and diagrams.
Beveridge, Sir W., 42 *n.*
Biebrich, gas tariff, 121 f.
Blind Persons' Fares, *see* tramway industry, tariffs.
Blochmann, 20 f.
Block Tariffs, *see under* tariffs.
Bochum, electricity, special industrial tariff, 166; gas, early history, 21; R.W.E., 35; tramway, common system with Gelsenkirchen, 190 *n.* *See also* tables and diagrams.
Brauer, Dr., 8 *n.*
Bremen:
  electricity, special domestic tariff, 162.
  gas, early public supply, 21.
  water tariff, 100; meter rents, 103.
  See also tables and diagrams.
Breslau:
  electricity, special industrial tariff, 166.
  gas, establishment of private works, 21; typical undertaking, 30 f.
  See also tables and diagrams.
Broodbank, Sir J., 17 *n.*
Brunswick, pioneer in tramway industry, 21.
Burns, C. D., 17 *n.*
Burtt, P., 66.

Capacity Factor, 79 f.
Cassel, city of, 21.
Charges, *see* price-differentiation, tariffs.
Chemnitz:
  electricity, public undertaking transformed into private, 23 *n.*; special industrial tariff, 166; typical of early history, 22 f., 31.
  water tariff, 100; meter rents, 104.
  See also tables and diagrams.
Chéron, M., 11 *n.*
Children's Fares, *see* tramway industry, tariffs.
Clark, J. M., cost of extensions, 68 *n.*; load factor, 79; nature of public

utilities, 60; 'what market will bear', 69 *n*.
CLARKE, Sir G., 17 *n*.
COAL CLAUSES, in electricity tariffs, 180.
COLOGNE:
  electricity, special domestic tariff, 162; special industrial tariff, 166; standing charges, 176.
  gas, establishment of private works, 21.
  R.W.E., 34.
  tramways, fares during inflation period, 43; pioneer in industry, 21; workman, definition of, 195.
  water, fire hydrants, 88, 105; meter rents, 103.
  See also TABLES and DIAGRAMS.
COMMUNAL CONSUMPTION:
  electricity, 152.
  gas, 118, 122.
  tramway services, 189, 195.
  water, 86–7, 90.
COMPETITION:
  between gas and electricity, 113 f., 118, 125 f., 151 f., 157.
  between gas and other fuels, 124.
  indirect in German public utility industries, 5–6.
  problem of, in public utilities, 2.
  See also MONOPOLY, POLYPOLY.
COMPROMISE FORMS OF MANAGEMENT, 33–52.
CONSUMER COSTS, *see* COSTS, customer.
CONSUMPTION of public utility services in British and German cities, 73 *n*.
  See also COMMUNAL CONSUMPTION.
CONVENIENCE FACTOR, defined, 114; unimportant in industry, 124.
*COSTS:
  customer costs, diagrammatic treatment, 95–7; gas, 132–6; imputation of, 65–70, 95–7, 155; water, 71 f.
  electricity, 139.
  gas, 109, 132–6, 154 f.
  imputation, 65 *n*., 95–7, 132–6. *See also* TARIFFS.
  joint, 65 *n*., 213.
  nature, 213.
  overhead, defined, 62–4; effect, 61.
  prime, 63 f.
  role of, in public utilities, 60–71.
  tramways, 184.
  water, 71–4, 154 f.
CURRENCY-INFLATION, 43 f.
CUSTOMER-CLASSIFICATION:
  as an instrument of price-differentiation, 120.
  electricity, 156–69.
CUSTOMER-CLASSIFICATION (*cont.*)
  gas, 120–8.
  tramways, 190–6, 211.
  water, 88–92, 120.
  See also PRICE-DIFFERENTIATION.
CUSTOMER COSTS, *see under* COSTS.

DELIUS, Dr.:
  mixed undertaking, history, 48 f.; motives, 37 *n*.; origin, 33; statistics, 41.
DEMAND:
  discouragement of, 147–50.
  for electricity, 139–45.
  for gas, 110–15, 125.
  for tramway services, 184–6.
  for water, 77–83.
DEUTSCHE GAS-GESELLSCHAFT, 11.
DIFFERENTIATION, *see* PRICE-DIFFERENTIATION.
DINSLAKEN, 35.
DISCRIMINATION, *see* PRICE-DIFFERENTIATION.
DISCOUNT, *see under* TARIFFS.
DISCOURAGEMENT OF DEMAND, 147–50.
DOMESTIC CONSUMPTION of public utility services, 73 *n*.
DOMESTIC TARIFFS, *see* ELECTRICITY-SUPPLY INDUSTRY, tariffs.
DORTMUND, establishment of private gas works, 21; meter rents in water tariffs, 103 f.; R.W.E., 35.
  See also TABLES and DIAGRAMS.
DRESDEN:
  electricity, special industrial tariff, 166.
  gas, pioneer in public supply, 20; slot-meter tariff, 127; special tariff, 123.
  improved public management, 47.
  tramways, transfer ticket, 205.
  water, communal consumption, 90; fire hydrants, 88; tariff, 98.
  See also TABLES and DIAGRAMS.
DUISBURG:
  electricity, off-peak lighting tariff, 164.
  gas, building of private works, 21; slot-meter tariff, 127.
  tramways, children's fares, 192 f.
  water tariff, 98.
  See also TABLES and DIAGRAMS.
DÜSSELDORF:
  electricity, advertisement tariff, 163 *n*.
  gas, consumption, 125.
  R.W.E., 34.
  tramways, 'social' fares, 189, 196; Sunday fares, 209.
  water, communal consumption, 90;

Düsseldorf (*cont.*)
fixed charge for hydrants, 105; fixed-charge tariff, 90, 106; meter rents, 103 f.; tariff, 100.
See also tables and diagrams.

Economists, and public utilities, 213.
Egetmeyer, Dr., 121.
Einheitstarif, *see* tariffs, flat-rate.
Elberfeld:
electricity, coal clause, 180; pioneer in public supply, 19.
gas, establishment of private works, 21.
tramways, definition of workman, 194 f.; pioneer in, 21.
water tariff, 93.
See also tables and diagrams.
Electricity-Supply Industry:
charges, 154–82.
classification of customers, 156–69.
competition of gas, 113 f., 118, 151 f., 157.
economic characteristics, 139–51.
history, 22 f., 30–2, 18–59 passim.
management, 18–59 passim.
social characteristics, 151 f.
substitutes, 113 f., 118, 140 f., 151 f., 157.
tariffs, 169–81; need for standardization, 216; too numerous, 169.
Elvers, Dr., 114.
English Influence:
on German gas industry, 19–21.
on German water-supply industry, 29.
Essen:
gas, building of private works, 21.
R.W.E., 34 f.
tramways, scholars' fares, 190.
water, communal consumption of, 90, 100; meter rents, 103 f.
See also tables and diagrams.
Estimate of Consumption, as basis for water charges, 82, 104 f.
Evans, A. D., 68.
Experiment:
period of, with mixed undertakings, 33–52.
room for, in electricity tariffs, 181.
room for, in gas and tramway tariffs, 216.

Fair Prices, 14–15. *See also* price-differentiation.
Falck, Dr., 121.
Fares, tramway, 196–212.
Farrer, T. H., 86.
Ferngas, 116.
Fire-Hydrants, water supplies for, 88, 105.
Fixed-Charge Tariffs, *see under* tariffs.
Frankfort:
electricity, advertisement tariffs, 163 *n.*; special industrial tariffs, 166; tariff scheme, 168 n.
gas, establishment of private works, 21; special tariff, 123.
tramways, business-men's fares, 195; definition of workman, 194; kilometre fare system, 183; morning fares, 210; pioneer in industry, 21; 'social' fares, 189 f., 195 f.
water, fixed charge for hydrants, 105; river water, 88 f.
See also tables and diagrams.
Friedrichs, K., 13.

Gas-Supply Industry:
charges, 120–38.
classification of customers, 120–8.
competition of electricity, 113 f., 118, 151 f., 157.
convenience factor, 114, 124.
economic characteristics, 109–17.
Ferngas, 116.
history, 30 f., 18–59 passim.
management, 18–59 passim.
small consumers, 131–4.
social characteristics, 117 f.
substitutes, 113 f., 118, 124–6, 151 f., 157.
tariffs, 129–38, 216.
Gelsenkirchen:
gas, building of private works, 21; business tariff, 123; charges for cooking, 125; industrial tariff, 125; slot-meter tariff, 127; substitutes, 125 f.
tramways, common system with Bochum, 190 *n.*
water, domestic tariff, establishment of mixed undertaking, 29 f.; meter rents, 103 f.; special domestic tariff, 100; standing charges, 102; tariff, 91.
See also tables and diagrams.
German Union of Local Authorities, 12, 13 *n.*
Gerber, Dr., 33.
Glaeser, M., fair profits, 15; general bibliography of public utilities, 4.
Grundgebührentarif, *see* tariffs, two-part.

Hagen, 35.
Halle:
electricity, special domestic tariff, 162; special industrial tariff, 166.

HALLE (*cont.*)
  gas, early public supply, 21.
  public undertakings, common management, 48; typical, 46 f.
  tramways, municipalization of, 32; typical, 21 f.; uniform-fare system, 199.
  water, cholera, 30; early supplies, 82 *n.*
  See also TABLES and DIAGRAMS.
HAMBURG:
  electricity, special industrial tariff, 166; standing charges, 175 *n.*
  gas, establishment of private works, 21.
  tramways, children's fares, 183 *n.*; common system with Altona, 190 *n.*; family tickets, 196 *n.*; pioneer in private operation, 19; uniform-fare system, 199.
  See also TABLES and DIAGRAMS.
HAMMOND, M. B., 64.
HANOVER:
  gas, history of management, 31; pioneer in private supplies, 19; wash-house tariff, 123.
  tramways, pioneer in, 21.
  water, river water, 88 f.
  See also TABLES and DIAGRAMS.
HART, Sir W., 13 *n.*
HAWTREY, R. G., 17 *n.*
HEIDELBERG, 197, 202.
HEINE, Dr., 9 *n.*
HIGH-TENSION ELECTRICITY, 180.
HOPKINSON TARIFFS, 175.
HOUSING SCHEMES, and electricity, 151 f., and gas, 128, and tramways, 4, 188 f.
HURCOMB, C. W., 17 *n.*
IMPERIAL CONTINENTAL GAS ASSOCIATION, 20 f.
IMPUTATION, *see* COSTS, PRICE-DIFFERENTIATION, STANDING CHARGES.
INFLATION, 43 f.
INSTITUTE OF PUBLIC ADMINISTRATION:
  bibliography of control, 17.
  general bibliography of public utilities, 4.
  'service at cost', 15.
INTERNATIONAL UNION OF LOCAL AUTHORITIES, 11.

JOHNSON, J. R., 17 *n.*
JOINT COSTS, *see under* COSTS.
JOINT SUPPLY, *see* COSTS, joint.

KARDING, Dr., 9 *n.*
KEYNES, J. M., 47 *n.*
KIEL:
  electricity, off-peak lighting tariff, 164; special domestic tariff, 162; special industrial tariffs, 166; standing charges, 167 f.
  gas, early public supply, 21; small consumers, 132 f.; slot-meter tariff, 127.
  water, industrial tariff, 91, 94, 100.
  See also TABLES and DIAGRAMS.
KIRKALDY, A. W., and A. D. EVANS, 68.
KNOOP, D.:
  bibliography of tramway charges, 212; of water industry, 87; of water charges, 108.
  electricity industry, capacity of plant, 147; characteristics of, 152; competition with gas, 113 f.; price-differentiation between districts, 150 f.; power rates, 156.
  gas industry, public importance of, 117; characteristics of, 119; cooking and heating tariffs, 125; competition with electricity, 113 f.; tariffs, 138.
  tramway industry, charges, 212; characteristics, 189 *n.*, kilometre fare system, 183; uniform fare system, 198 f.; transfer system, 202–5; fare-stage method, 197; definition of workman, 195.
  water industry, charging by meter, 106; charges, 108.
KÖNIG, C., 6 *n.*
KÖNIGSBERG:
  electricity, advertisement tariffs, 163 *n.*; history of management, 48; pioneer in public supply, 19; public undertaking made private, 23 *n.*
  gas, early public supply, 21; wash-house tariff, 123.
  municipal company, not formed from public undertaking, 46 *n.*; common operation by, 48.
  tramways, family tickets, 196 *n.*
  See also TABLES and DIAGRAMS.

LAW, German:
  charges, 17.
  competition, 5.
  management, 13.
  profits, 15.
LEIPZIG:
  electricity, heating tariff, 165.
  gas, pioneer in public supply, 20; slot-meter tariff, 127.
  improved public management, 47.

LEIPZIG (*cont.*)
  tramways, war-cripples' fares, 196; workmen's tickets, 195.
  water, establishment of works, 18; meter rents, 103 f.; tariff, 100.
  See also TABLES and DIAGRAMS.
LIBERAL INDUSTRIAL INQUIRY, 47 *n.*
LIGHTING RATES, *see* PRICE-DIFFERENTIATION, TARIFFS.
LINDEMANN, Prof., 12 *n.*
LOAD CURVES:
  electricity, 144, 146, 148.
  gas, 112.
  theory, 77–9, 147–50.
  tramway, 187 f.
  water, 77 f.
  See also LOAD FACTOR.
*LOAD FACTOR:
  defined, 79.
  discounts, in electricity tariffs, 179.
  in electricity industry, 155.
  in gas industry, 154 f.
  in water-supply industry, 154.
  modification of, 147–50.
  See also CAPACITY FACTOR, LOAD CURVES, PEAKS.
LUDEWIG, H., 17 *n.*
LUEKEN, Dr., 44.
LUMP-SUM TARIFF, *see* TARIFFS, fixed-charge.
LUPPE, Dr., 9 *n.*

MACKENZIE, J. L., 17 *n.*
MAGDEBURG:
  electricity, accumulator tariff, 165; special domestic tariff, 162; standing charges, 174, 175 *n.*; wash-house tariff, 161.
  gas, early public supply, 21; slot-meter tariff, 127.
  water, meter rents, 103.
  See also TABLES and DIAGRAMS.
*MANAGEMENT OF PUBLIC UTILITIES:
  compromise forms of, 33–52.
  future of, in Germany, 59.
  history of, in Germany, 18–59.
  mixed, 8–12; in Germany, 33–52.
  of German electricity undertakings in 1928, 57 f.; gas undertakings in 1926, 57; tramway undertaking in 1928, 58; water undertakings in 1927, 57.
  private, of German public utilities, 20–8; objections to, 7.
  public, in Germany, 29–33; number of tariffs employed under, 214; objections to, 7.
  See also LAW, REGULATION, and TABLES and DIAGRAMS.
MANNHEIM:
  electricity, load-factor discount, 179 *n.*; special industrial tariffs, 166.
  gas, establishment of private works, 21; consumption of, 125.
  tramways, cripples' fares, 196; definition of workman, 194 f.; ticket, 203.
  water, meter rents, 103 f.; minimum charge, 102 f.
  See also TABLES and DIAGRAMS.
*MARKET:
  division of, 74–7.
  electricity, 139–45.
  gas, 110–15.
  nature, 74.
  tramway services, 184–6.
  water, 77–83.
  See also CUSTOMER-CLASSIFICATION, PRICE-DIFFERENTIATION.
MARSHALL, A.:
  overhead costs, 65.
  'what market will bear', 69 *n.*
MAUL, Dr., 8 *n.*
MEASUREMENT:
  electricity, 139.
  gas, 109.
  tramway services, 183 f.
  water, 74.
METER RENTS, *see under* STANDING CHARGES.
MINIMUM CHARGES:
  in water tariffs, 102; nature of 170.
MITZLAFF, P., and E. STEIN:
  management, 52.
  mixed undertakings, 41 *n.*
MOEGLICH, A., 12 *n.*
MOHRMANN, Dr., 9 *n.*
MONOPOLY:
  the first problem, 2; solution in Germany, 5; differentiating, 75.
  See also POLYPOLY.
MOON, W., 17 *n.*
MÜNCHEN-GLADBACH, 34.
MUNICH:
  electricity, accumulator tariff, 165; domestic tariffs, 162; stair-case lighting tariff, 178; tariff-scheme, 168 *n.*
  gas, establishment of private works, 21.
  tramways, fares for municipal officials, 195.
  water, extra-municipal supplies, 90; meter rents, 103 f.; tariffs, 100.
  See also TABLES and DIAGRAMS.
NEUSS, 34.
NORWICH TARIFF, 176.
NÜBLING, Dr.:
  charges for gas, 119.

NÜBLING (*cont.*)
  differentiation of gas prices between districts, 117.
  Stuttgart investigation, 133 f.
  substitutes for gas, 124.
NUREMBERG:
  electricity, accumulator tariff, 165; peak periods, 179 *n.*; special domestic tariff, 162.
  gas, establishment of private works, 21.
  water, extra-municipal supplies, 90.
  tramways, definition of workman, 194 f.
  See also TABLES and DIAGRAMS.

ONE-PART TARIFFS, *see under* TARIFFS.
OVERHEAD COSTS, *see under* COSTS.

PASSOW, R.:
  bibliography on methods of control, 17.
  history of management, 59.
  mixed undertaking, definition of, 8; early history of, 33; future of, in 1912, 41; motives for forming, 37 *n.*
  public management, 39 f.
  R.W.E., 34–6.

PAUSCHALTARIF, *see* TARIFFS, fixed-charge.
*PEAKS:
  electricity, 141 f., 179 *n.*
  gas, 111.
  importance of, 78.
  tramway, 185 f.
  water, 77.
  See also ACCUMULATORS, LOAD FACTOR, STORAGE.
PICHLER, Dr.:
  inflation, 44.
  motive for mixed undertakings, 38 *n.*
  municipalization, 32.
  public operation, 7 *n.*
PIGOU, A. C.:
  area of gas supply, 117.
  bibliography of control, 17.
  conditions of price-differentiation, 75.
  discrimination, 69 *n.*
  imputation of overhead costs, 65 *n.*
PLANT FACTOR, *see* CAPACITY FACTOR.
POLITICS:
  and public utilities, 213.
  and electricity charges, 154.
POLYPOLY, 75.
POTSDAM, standing charges in electricity tariff, 176.
POWER RATES, *see* TARIFFS, electricity.
*PRICE-DIFFERENTIATION:
  between areas, electricity, 150 f.; gas, 122 f.; tramways, 188; water, 84 f., 90.
  conditions, 70, 74–7.
  customer-classification (q.v.), 120.
  dilemma of, 215–16.
  defined, 2–3, 213.
  electricity, 169.
  fair prices, 14 f.
  flat rate, 94.
  industrial tariffs, 123 f.
  motives, 3 f., 70.
  problems, 2–4, 16–17, 213, 215–16.
  public authorities, 86 f.
  public opinion, 107.
  regulation, 3 f.
  tramway, 4, 196.
  Vienna, 3, 92.
  water, 74 f., 82–92.
  See also COSTS, TARIFFS.
PRIME COSTS, *see under* COSTS.
PRIVATE ENTERPRISE, extent to which responsible for building up public utility industries, 23. *See also* under MANAGEMENT.
PRIVATE MANAGEMENT, *see under* MANAGEMENT.
PROFITS as costs, 71; in Germany in 1929, 16; regulation of, 2, 14–16; of municipal undertakings, 15.
PRUSSIAN UNDERTAKINGS, management of, 56 f.
PUBLIC HEALTH, and electricity, 151 f., and gas, 117 f., 133, and tramways, 188 f., and water, 85 f. *See also* HOUSING SCHEMES.
PUBLIC MANAGEMENT, *see under* MANAGEMENT.
'PUBLIC UTILITY ECONOMICS', 213.

RATES, electricity, *see* ELECTRICITY-SUPPLY INDUSTRY, tariffs; relief of, 15, 86 f.; water, *see* WATER-SUPPLY INDUSTRY, tariffs.
REGULATION OF PUBLIC UTILITIES, basis of, 60; bibliography of, 17; heterogeneity of, 1; in America, 1, 7; in England, 1, 7; in Germany, 1, 5–59, and passim; motives of, 3; primarily concerned with prices, 1; problems of, 2; ubiquity of, 1. *See also* MANAGEMENT, LAW.
RHEIN, Dr., 8 *n.*
RHEINISCHWESTFÄLISCHE ELEKTRIZITÄTSWERKE, A.G.: and technique of electricity-distribution, 12; coal clause in electricity tariffs, 180; history of, as typical mixed under-

taking, 34–41; special industrial electricity tariff, 166; supplies electricity to Essen and Gelsenkirchen, 158 *n.*
RHEYDT, 34.
RITTER, Dr., 9 *n.*
RIVER WATER, 88 f.
RUHRGAS A.G., 12.
RUMPF, Dr., 147.
R.W.E., *see* RHEINISCHWESTFÄLISCHE ELEKTRIZITÄTSWERKE, A.G.

SCHÄFER, Dr., 119.
SCHMID, E., 9 *n.*
SCHMUDE, Dr., fares in Frankfort 199 f.; fares in Halle, 199.
SCHOLARS' FARES, *see* TRAMWAY INDUSTRY, tariffs.
SCHOMBURG, Dr., charges for gas, 119. substitutes for gas, 124–6.
SEASON TICKETS for tramways, 208 f. *See also* TRAMWAY INDUSTRY, tariffs.
SIEGEL, G., bibliography of electricity industry, 153; electricity tariffs, 182; reasonable meter rents, 172.
SLOT-METERS, *see* TARIFFS, prepayment.
SMALL CONSUMERS, of gas, in Germany and Austria, 133 f.; of gas, interests of, 131–4.
SOCIAL EXPERIMENT in public-utility industries, 3.
SOCIALISM in Germany, 1918–21, and municipal enterprise, 43.
SOLINGEN, 35.
STAFFELTARIF, *see* TARIFFS, step.
STAIR-CASE LIGHTING TARIFF for electricity, 166 f., 178.
STANDARDIZATION OF TARIFFS, 216.
STAND-BY DEMAND, costs of, 145; nature of, 141, 180; tariffs for, 180.
STANDING CHARGES:
  justification of, 173.
  meter rents, electricity, 171–7; gas, 135 f.; nature, 103; water, 100, 103 f.
STATISTICS, relating to electricity tariffs, 158 *n.*; relating to gas tariffs, 130 *n.*; relating to electricity, need for, 181 *n.*–182 *n.*; relating to tariffs, need for, 214. *See also* TABLES and DIAGRAMS.
STETTIN:
  electricity, pioneer in industry, 19, 22.
  gas, pioneer in public supply, 21.
  municipal undertakings, and improved management, 47, and joint management, 48.
STETTIN (*cont.*)
  tramways, fares and inflation, 43; ticket, 203.
  water, tariff, 97 f.; typical undertaking, 29.
  See also TABLES and DIAGRAMS.
STINNES, H., 34, 37 f.
STORAGE of electricity, 145–50; of gas, 115 f.; of tramway services, 186–8; of water, 83 f. *See also* ACCUMULATORS, LOAD FACTOR.
STRASBURG, 42.
STRÖLIN, Dr., aim of gas tariffs, 138; convenience factor, 114, 124; German gas prices in 1930, 119, 130 *n.*
STUDENTS' AND APPRENTICES' FARES, *see* TRAMWAY INDUSTRY, tariffs.
STUFENTARIF, *see* TARIFFS, discount.
STUTTGART:
  electricity, accumulator tariff, 165; heating tariff, 165; history o management, 31 f.; special domestic tariff, 162; wash-house tariff, 161.
  gas, establishment of private works, 21; slot-meter tariff, 127 f.; special tariff, 123.
  water, fixed-charge tariff, 90, 105 f.; extra-municipal supplies, 90.
  See also TABLES and DIAGRAMS.

*TARIFFS:
  alternative, 134 f.
  block, defined, 99; electricity, 170; gas, 129; water, 99.
  coal clauses, 180.
  defined, 88, 93.
  discount, defined, 93, 95; electricity, 170; gas, 129; water, 95–100, 101 f.
  domestic, electricity, 160–2; gas, 123.
  electricity, 159–82.
  fixed-charge, defined, 93, 105; electricity, 178; gas, 129; water, 104–6.
  flat-rate, defined, 93; discussed, 94; electricity, 170; gas, 129; water, 93 f.
  gas, 129–38, 154 f.
  ideal, electricity, 181; gas, 137 f.; tramway, 211 f.; water, 107 f.
  industrial, electricity, 166; gas, 123 f., 129; water, 91 f.
  law, 17.
  lighting, 156–8, 164, 166 f.
  load-factor discounts, 179.
  minimum-charge, 102 f., 170.
  multiplicity of, 120 f., 169, 214.

Tariffs (*cont.*)
  number of, under public management, 214.
  one-part, defined, 92 f.; discussed, 129; electricity, 170; gas, 129; water, 93–100.
  possibility of experiment, 181, 216.
  power, 156–8, 164–6.
  prepayment, 128.
  social considerations, 154.
  standardization needed, 216.
  step, discussed, 98; electricity, 170; gas, 129; water, 95–9.
  tramway, 196–212.
  two-part defined, 93; discussed, 100 f., 129–36; electricity, 170–8; gas, 129; standing charge in, 103 f., 134–6, 171–8; water, 100–2. *See also* standing charges.
  time of consumption, 178–80.
  water, 92–108, 154.
Tariff-Schemes, 168.
Time of consumption as a factor in electricity tariffs, 178–80.
Thyssen, A., 34.
Tramway Industry:
  charges, 190–212.
  classification of customers, 190–6; a social problem in Germany, 211.
  competition, 5 f.
  economic characteristics, 183–8.
  fares, 196–212.
  history, 18–59 passim.
  management, 18–59 passim.
  municipalization of, 32 f.
  social characteristics, 188 f.
  tariffs, 196–212; experiment with, 216.
Transferability of Commodities, 75.
Twin Companies, 11.
Two-Part Tariffs, *see under* tariffs.

Uniformity of Prices, 60, 213. *See also* price-differentiation.

Verband der Gemeinde- und Staatsarbeiter, 17.
Verbesserte Regiebetriebe, 44. *See also* management.
Vereinigte Elektrizitätswerke Westfalen, 12.
Vienna:
  gas, small consumers, 133 *n.*
  tramways, children's fares, 192 *n.*; municipalization, 32; ticket, 204.
  water, domestic tariffs, 91, 99, 106; industrial tariff, 91; tariff, 100.
  See also tables and diagrams.

Waste of water, 82, 105.
Water-Supply Industry:
  charges, 88–108.
  classification of customers, 88–92.
  economic characteristics, 60–85.
  history, 18–59 passim.
  management, 18–59 passim.
  social characteristics, 85–7.
  tariffs, 92–108.
Watkins, G. P.:
  bibliography of electricity industry, 153; bibliography of electricity tariffs, 182.
  costs, imputation of, 69 *n.*
  customer-classification, 158, 169.
  domestic tariffs, 160 f.
  political nature of tariff question, 154.
  power demand for electricity, 156.
  power rates, original level, 158.
  stand-by supplies, 141, 180.
Wiesbaden, 21.
Workmen's Fares, *see* tramway industry, tariffs.

Zonentarif, *see* tariffs, block.

PRINTED IN GREAT BRITAIN AT THE UNIVERSITY PRESS, OXFORD
BY JOHN JOHNSON, PRINTER TO THE UNIVERSITY